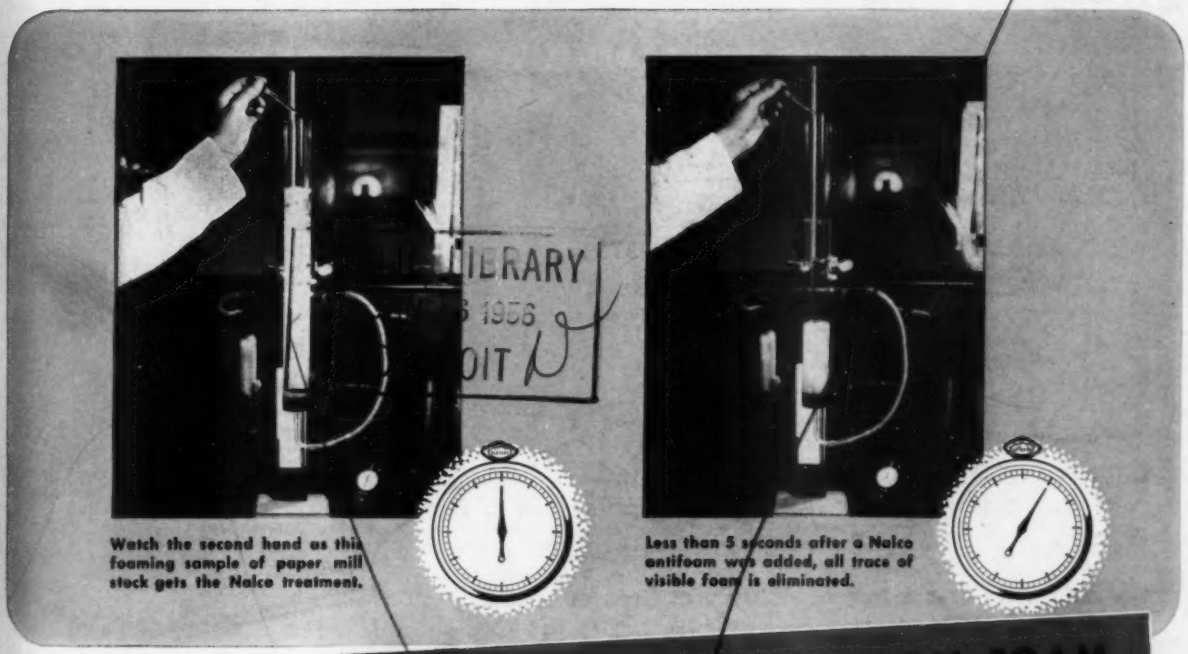
- Industry leaders' forecast
- Batch and continuous alkaline pulping
- More evidence for the moving interface mechanism
- New polyethylene extruder

The Paper Industry

Publishers of PAPER AND PULP MILL CATALOGS



Watch the second hand as this foaming sample of paper mill stock gets the Nalco treatment.

Less than 5 seconds after a Nalco antifoam was added, all trace of visible foam is eliminated.

furthermore...

Nalco GETS THE DROP ON FOAM YOU CANNOT SEE!

●The simple demonstration above leaves no doubt that Nalco chemicals quickly and effectively eliminate all visible foam.

But here are even more conclusive findings: (1) In a mill where there was *no visible sign* of foam, the application of a Nalco antifoam quickly produced a very substantial increase in screening efficiency ... and overall production; (2) In another mill, Nalco chemicals solved the problem of an erratic Decker level where there seemingly was no foam. Here, too, production went up through increased Decker capacity.

Simplest explanation of Nalco effectiveness is the dual action—*antifoam* action to prevent bubbles from forming ... *defoaming* action to combat existing foam! Your Nalco Representative has all the facts, or write direct.

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Alchem Limited, Burlington, Ontario
NORTHWESTERN UNITED STATES, HAWAII AND ALASKA
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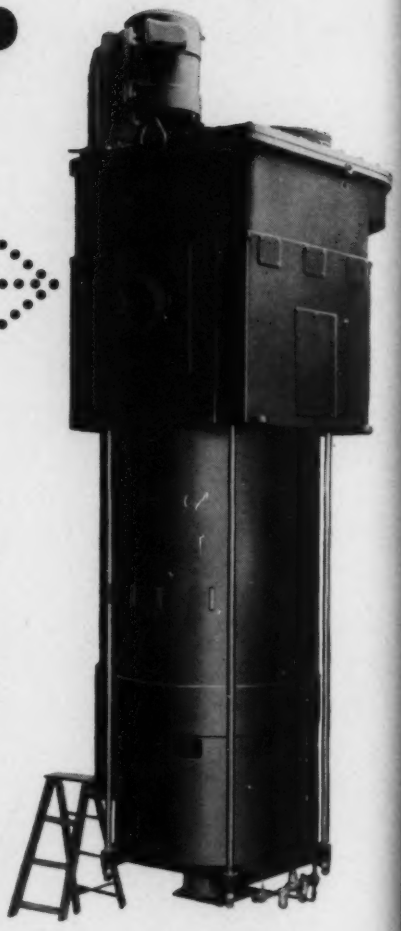
THE *Nalco*® SYSTEM . Serving the Paper Industry through Practical Applied Science

PULP CAN BE *MORE* PROFITABLE!

Eliminate costly WET LAP shipping!

NEW JACKSON & CHURCH SYSTEM OF "CRUMB TRANSPORT" CUTS LABOR AND MAINTENANCE COSTS... SAVES TIME AND MONEY!



J-C Continuous Pulp Press

For the custom mill or the integrated mill shipping "excess" pulp, there's big news in this new J-C system.

No longer is it necessary to ship wet laps or sheeted pulp. Now through the use of the J-C Continuous Press, pulp to be shipped is de-watered, bringing consistency up to 40%, and the resulting "crumbs" may be easily blown into cars or trucks for shipping, completely eliminating "wet lap" handling. The pulp "crumbs" are just as easily handled at the receiving end.

A minimum of labor is involved in either pressing or handling. Capital expense is lower than with any other method. J-C Pulp Press installations are available in capacities of 25 ton to 300 ton units.

Write today for additional information about this new Jackson & Church system of "crumb" transport . . . now in successful commercial operation in custom and integrated mills.

J-C

JACKSON & CHURCH CO. SAGINAW, MICHIGAN

Work well done since eighty-one

Test-Prove

KELSIZE

and

KELGIN

for uniform
high-density
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Five star performers!

Size-press or calender application of Kelsize or Kelgin provide controllable and uniform high-density in all grades of paper and paperboard, fourdrinier or cylinder.

Improved Finish
Reduced Ink Consumption
Better, More Uniform Printability — Flat To Full Gloss
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REFINED ALGIN PRODUCTS

For technical assistance in applying Kelsize or Kelgin in your plant, contact the nearest Kelco regional office

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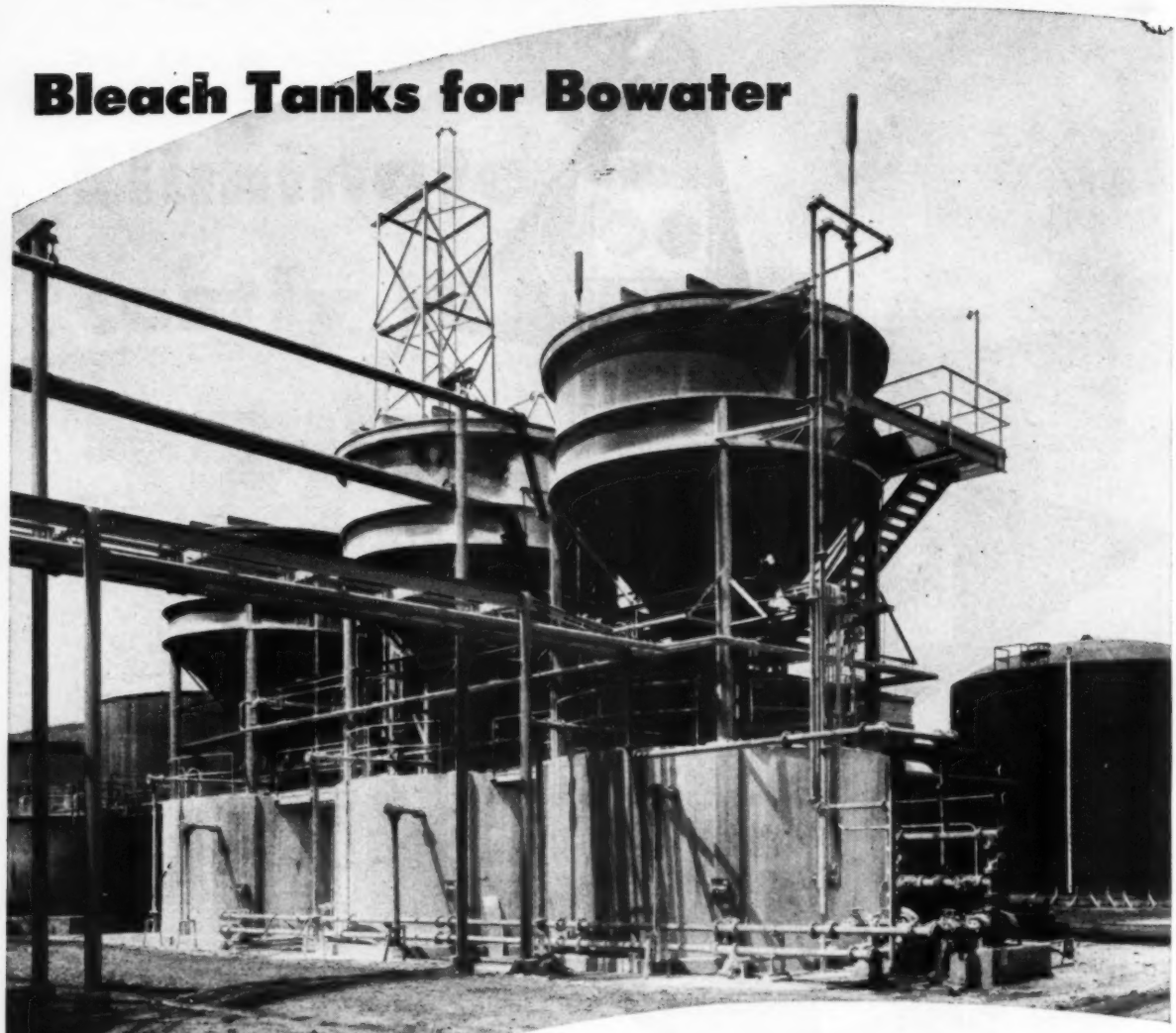
Bleach Tanks for Bowater



. . . Built by CB&I

The three bleach tanks shown above were built by Chicago Bridge & Iron Company for Bowater Paper Company's new $55 million newsprint and kraft mill at Calhoun, Tennessee. CB&I also fabricated and erected 60 other steel plate structures including five digesters to handle the mill's daily production of 312 tons of raw kraft.

Steel plate structure craftsmen for over 65 years, CB&I designs, fabricates and erects storage tanks, digesters, Conkey evaporators, elevated tanks and other structures for the pulp and paper industry. Write our nearest office for further information, estimates or quotations.

CB&I

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

The Paper Industry

Technology • Engineering • Management • Production

VOLUME 37 • NUMBER 10 • JANUARY 1956

Features . . .

Editorial — Continuous vs. batch pulping 925

Whither? — Organic waste utilization, 1956 output, static electricity control, timber resources 984

Optimism keynotes industry's outlook for 1956 921

Theoretical considerations of rapid continuous pulping 926
by W. J. Nolan

Covington's experience with continuous pulpers 933
by James M. Loving

New developments in digesters and digestion techniques 934
by Lee Eberhardt

A review of some kraft pulping variables 935
by M. N. May

Kraft cooking for easy bleaching and board pulps 938
by Fred W. Bishop

Polyethelene extrusion coating 943
by Ernest C. Bernhardt

New results and ideas in plastic coatings 944

Wisconsin mills lead way in nation's stream pollution effort 948

Wisconsin pioneers in stream survey technique 949
by A. J. Wiley

Station KVP-TV on the air 957

News . . .

News of the Industry 948

Allied News 962

Names in the News 965

Necrology 966

Departments . . .

Current Comments 947

Patent Reviews 968

Foreign Abstracts 972

New Products 975

Coming Events 980

Current Market Quotations 981

New Literature 982

Index to Advertisers 983

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HAVE YOU HEARD ABOUT HUYCK'S

BOARD MILLS REPORT

- Ran 28 days. A record run. Average for untreated is 20 days.
- On 21 days. Operation excellent. Average life 12 to 15 days.
- 18 days trouble-free life. Held size and did not fill up.
- On 31 days. Average life 21 to 25 days. Best felt ever on this position.

FINE MILLS REPORT

- Ran 19 days vs. 6 to 11 days average. Did not narrow.
- Ran 50 days. This is a new record.
- On 38 days. Average life 20 to 24 days. Broke mill record of 29 days.
- Felt ran cleaner and softer. Good life.

TISSUE MILLS REPORT

- Ran 21 days vs. 11 to 13-day average. An excellent run.
- Ran 23 days. Life and operation very good.
- Ran 22 days, 4 to 5 days above untreated.
- Ran 20 days. Still had life, but removed at machine breakdown. Average life 12 to 14 days.

NEWSPRINT MILLS REPORT

- Ran 30 days. This is above average life.
- On record 53 days; range from 35 to 50 days in this position.
- On for 33 days; well above average life.
- On 20½ days. Average life about 18 days.

THE LATEST...

New 4-D TREATMENT?

This Case History Report Proves *It truly adds a 4th Dimension to felt performance!*

Seven months ago Huyck announced its amazing new 4-D TREATMENT one of the greatest advancements in modern feltmaking, *available only on felts made by Huyck.*

Today we give you a summary briefed on these pages of what a few of many leading mills have reported to us . . . stating that, in virtually all cases, the 4-D TREATMENT improves TOUGHNESS, FINISH and OPENNESS *all at once!*

Read the factual comments of these Papermakers and you'll see how the 4-D TREATMENT gives a higher resistance to wear so felts last longer . . . maintains openness and softness . . . improves size stability . . . and protects against both bacterial and chemical attack.

Get the full story of the 4-D TREATMENT from your Huyck Sales or Field Service Engineer. It's a big step toward producing better paper at lower felt cost per ton.

KRAFT MILLS REPORT

- On for 36 days. Several days above average life.
- Ran 14 days. Operated well and remained open.
- Ran 34 days. This is good life. Removed at shut down with life still remaining.
- Ran 12 days. Size stability and operation good. Above average life.

ROOFING MILLS REPORT

- Ran 16 days. Record for past year. Was not worn out.
- Gave 13½ operating days. Average life 5 days. One of the best runs to date, if not the best.
- Ran 11 days. Request all future felts with this treatment.
- Ran 18 days vs. average of 6 days.

Write today for your free copy of our booklet describing the new 4-D TREATMENT

NEW!

HUYCK FELTS

FIRST IN QUALITY . . . FIRST IN SERVICE

F. C. HUYCK & SONS • Rensselaer, New York
Established 1870

for maximum process stability and economy
now nondusting
Solar Colors
Unsurpassed for the tinting of white papers because they are least affected by fluctuations in pH or temperature. Solar Colors offer—
• Maximum brightness of shade
• Excellent light fastness
• Quick wetting-out
• Uniform dispersion

Solar Colors are now being delivered in a new nondusting, noncaking form which completely eliminates handling difficulties.

Solar Blues and Violets are available in a full range of shades which will produce tints of any possible hue for the brightest whites or coated papers with unexcelled color *performance*.

All these advantages are available at no extra cost.

Write for samples and technical information on the role of Solar Colors for tinting white papers.

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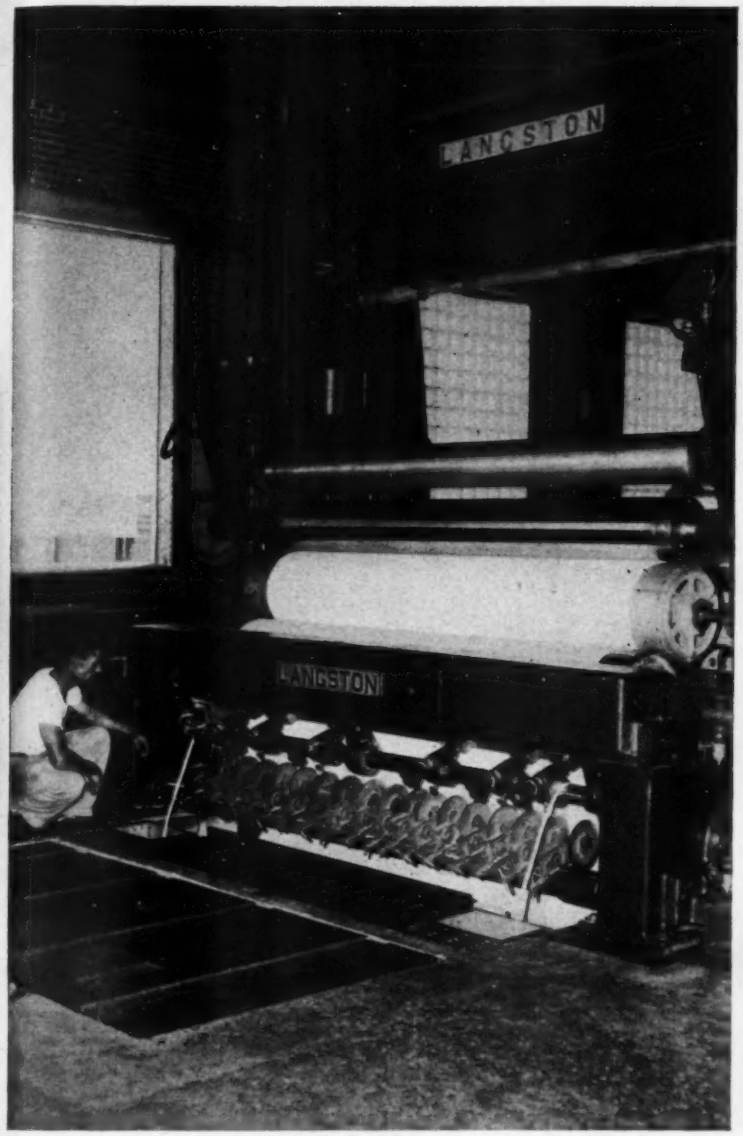


STARTING A ROLL. St. Regis operates this new machine at about 1000 feet per minute. During its first year's operation, the machine will slit and wind roughly *15,000 miles of board.*

Langston Slitter & Winder makes 26 perfect cuts per roll

LANGSTON SHEAR-CUT SLITTERS keep dust to a minimum. This means cleaner rolls; a cleaner plant; more accurate slitting; and square edges.

Performance report on new machine at St. Regis

"This new Langston winder makes money for us through better rolls and less waste." This remark was recently made by A. F. Downey, plant superintendent at the Pensacola, Fla., paper mill of St. Regis Paper Co. He was referring to the new Langston Slitter & Winder.

The machine's task is to slit heavy board used in the manufacture of milk cartons, butter cartons, paper cups, etc. Before installation of the machine, St. Regis had a major problem with checking and wrinkling—both of which created waste. Today they turn out as many as 26 cuts per roll—all perfect. "I think we could make 30 just as easily," said Mr. Downey.

The new Langston machine is a Model DH with 18-in.-dia. drums and idler rolls and other features specially built in to aid handling of the heavy board. Rolls slit and wound are 92 in. wide and of up to 72-in. dia. Operators praise the machine because it is so easy to operate.

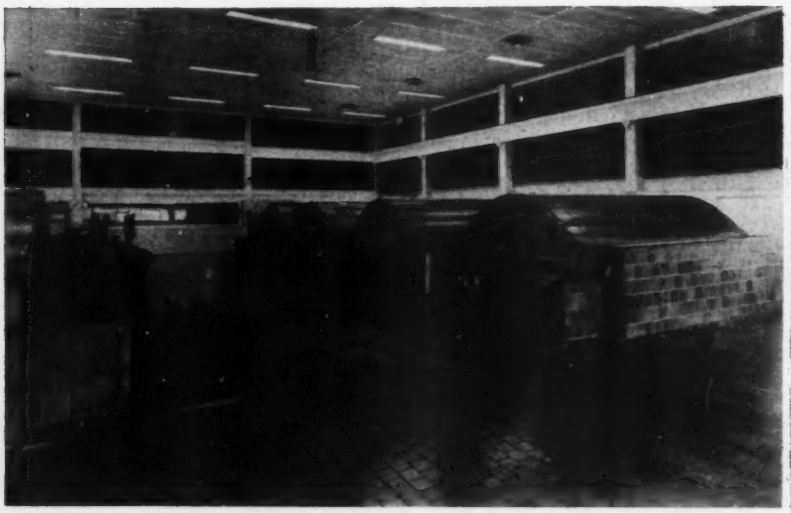
Langston Slitters & Winders are available in several standard types, each adaptable to special applications. Sizes range from 40 to 196 in. and in speeds to meet your specifications. Write for complete details. SAMUEL M. LANGSTON Co., Camden 4, N.J.

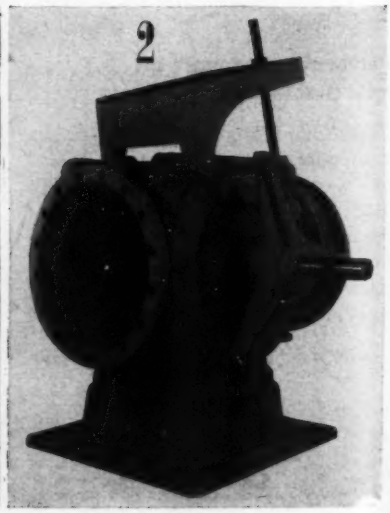
LANGSTON *Leadership...by design*

IMPCO

BLEACH PLANT EQUIPMENT

- Sherbrooke Machineries Limited, Sherbrooke, Quebec Manufactures Similar Equipment in Canada





IMPCO manufactures virtually all types of mechanical bleach plant equipment for new and old plant application. These component parts are readily adaptable for re-vamping existing plants, no matter what the sequence is or is planned to be. We welcome the opportunity to work with you and if necessary tailor the equipment to best satisfy your needs.

We have long recognized the fact that there is no such thing as a standard continuous bleach plant nor are we wedded to any particular sequence flow with corresponding arrangement of equipment. We will continue to develop equipment best suited to do your job.

1 **Bleach Washers**—Impco Vacuum Washers give highest washing efficiencies at low fresh water consumption. Every Impco Washer is "Tailored-for-the-job." Made in 3' - 5' - 8' - 9'6" and 11'6" diameter sizes up to through 20' lengths, in any material of construction.

2 **Line Mixers**—This low-density wabble plate chemical and chlorine Saver-Mixer provides a rapid mixing result which improves retention uniformity with a big savings in chemicals.

3 **Single Shaft Mixers**—This single shaft mixer built of solid hastelloy was developed for mixing liquid ClO_2 with hi-density pulp. Its single hastelloy rotor contained in a specially designed case delivers uniformly mixed pulp and chemical at the critical moment of reaction.

4 **Scraper-Screw Dischargers**—The unit pictured here is used in continuous down-flow type high density bleachers. Developed over twenty-five years ago, this mechanism offers the most positive and fool proof method of high density stock removal.

5 **Thick Stock Pump**—This positive displacement double rotor pump in solid type #316 stainless construction easily handles stock consistencies from 10% A.D. to 17% A. D. Built in two sizes, the series 300 will handle 350 T.P.D. and the series 500 will do 600 T. P. D. plus. This unit is used in virtually every ClO_2 bleach plant today and has a definite application in high density storage work.

6 **Pulp Circulators**—Built in three sizes in a combination of any acceptable materials for bleach plant work, this specially designed propellor circulator eliminates radial projection and puts the horizontal propulsion factors to work—Result?—A down flow high density bleacher that delivers uniformly, making short circuiting ancient history.

7 **Double Shaft Mixers**—These work horses of the bleach plant, rugged in design and thorough in their job of surrounding the individual fibre with chemical, continuously and intimately mix the chemical, steam and pulp through special internal features. Repeated field tests indicate thorough mixing in pieces of pulp as small as 25 milligrams in particle size.

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MACHINERY INC.
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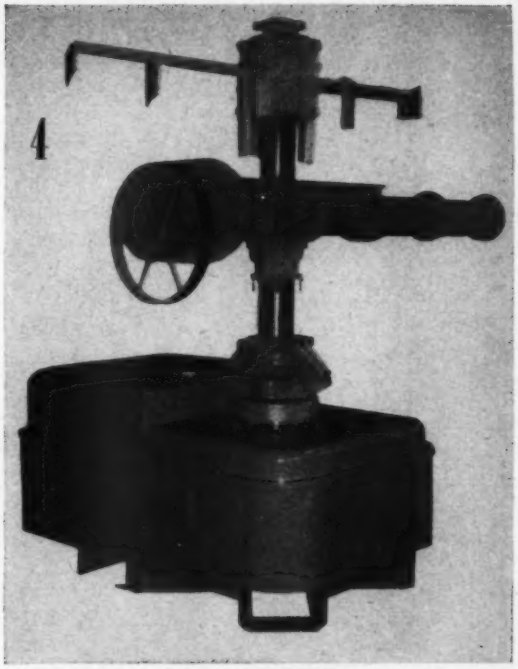

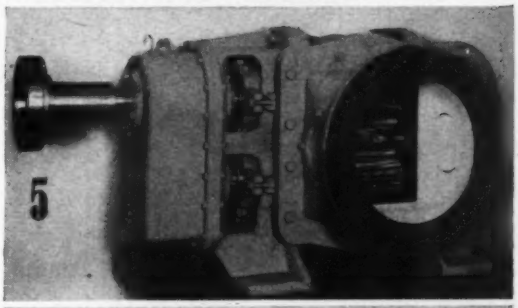

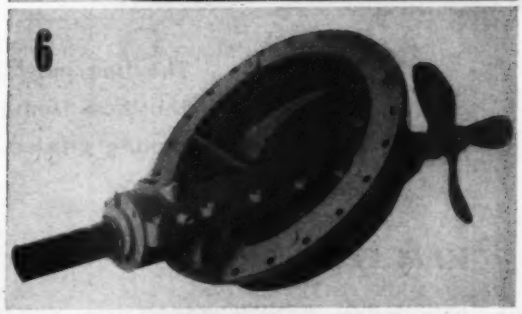

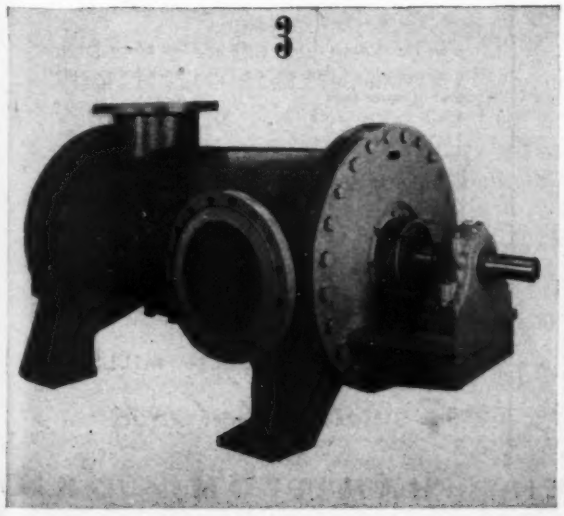

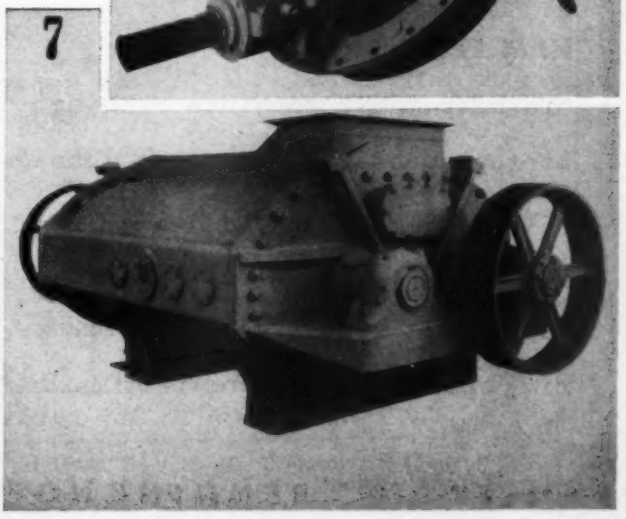

The fine machine-finished book and offset Roaring Spring Papers that flow from the machines at D. M. Bare have earned lasting favor among printers, publishers and wholesale paper merchants.

*** HAM FELTZ says:**

"To keep these machines running at top speed...turning out tonnage without broke or imperfections... requires felts that can 'take it'; felts that remove water at lightning speed and leave no felt marks."

From the thinnest tissue to the heaviest board, there is a Hamilton Felt that will do YOUR work better, faster and at lower cost!

Hamilton Felts

MIAMI WOOLEN MILLS

Established 1858

SHULER & BENNINGHOFEN, HAMILTON, OHIO

PRACTICAL FIELD EXPERIENCE SUPPLEMENTS OUR LABORATORY TESTS

WE GET THINGS DONE!

IF you have an unusual problem in meeting higher quality or higher strength specifications, check with us. The chances are we already have the answer you are seeking.

Our method is to combine practical plant experience with modern scientific research to solve a particular problem. Our field testing program is geared to the future demands of your customers.

This Morningstar individualized service is now well known from coast to coast. Let our Paper Department engineers, located near you, investigate and analyze your requirements. Let them demonstrate our ability to help you GET THINGS DONE!

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WE SUPPLY SPECIALTIES FOR . . .

1. Mullen
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Pulp Wood Chain
Material and Design both
contribute to the unique durability of
TISCO® MANGANESE STEEL CHAIN
Barking Drum Chain

A shutdown due to the failure of a "weak link" in a pulp wood conveyor chain or a barking drum chain can be enormously costly. That is why the largest companies in the Pulp and Paper Industry specify TISCO Manganese Steel Chain for these and other important uses. They expect and get several times the life from TISCO Chain that they do from other types used in these severe applications.

TISCO Pulp Wood Conveyor Chain gives notable performance due to its low frictional loss and its wide bearing area on conveyor trough or riding rails. Attachment links specifically designed for most efficient log handling are available.

TISCO Barking Drum Chain is especially designed for its work. It is not an adaptation of chain developed primarily for some other service. Its simplified construction not only increases strength but reduces the number of parts and expedites assembly. The center link is one integral unit and there are no bushings to break or loosen. Large bosses on the side links increase bearing on the pins, and greatly reduce pin and link wear.

Ask for further information regarding TISCO Pulp Wood Conveyor Chain, Barking Drum Chain and other chains, Jordan Plugs, Demountable Plug Sleeves and Liners, Beater Rolls and Bed Plates, Rag Slitters, Sprockets, and miscellaneous castings designed to meet your own operating requirements.

TISCO Manganese Steel Sprockets and Traction Wheels are strongly recommended for use with TISCO Conveyor and Barking Drum Chain.

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HARRISBURG STEEL CORPORATION

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There are Many Reasons for World Leadership of . . .

Layne

VERTICAL TURBINE PUMPS

Tested and proved in thousands of installations of all types, the world-wide leadership of Layne pumps has led the field for one overall reason—PERFORMANCE . . . under all kinds of operating conditions.

That envied, but never duplicated, performance record has been made for many reasons. These are a few:

1. Complete and undivided manufacturing responsibility: Every part of every Layne pump is manufactured in the Layne factory to Layne high standards.
2. Concentration on one make: A lifetime of experience is behind every Layne pump . . . and that accumulated "know how" is focused on one pump alone.
3. Proven design: The basic design of a Layne pump has been job tested under every conceivable operating condition. And that design is converted into a finished unit through a series of highly specialized and quality-controlled factory operations.

To know all the reasons why Layne pumps are preferred by Industry—Municipalities—and Agriculture, write for bulletin number 100.

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Water Wells · Vertical Turbine Pumps · Water Treatment

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Cuts the cost of steam

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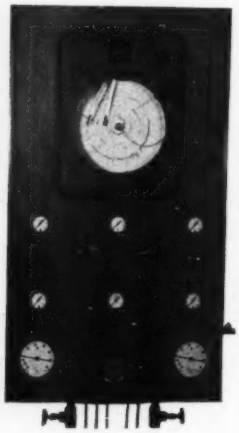


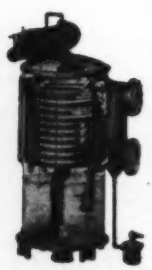
New "Electric Eye" on Stickle Moisture Control System Automatically Adjusts Dryer Steam Pressure When Break Occurs

Manual adjustment of steam supply is no longer necessary when a break occurs, thanks to a new "electric eye" control on the Stickle Moisture Control System. Actuated by a photo electric cell, steam is immediately shut off, or reduced to maintain any desired steam pressure during the break. The "electric eye" control is available as extra equipment on new systems, and may be incorporated on those now installed.

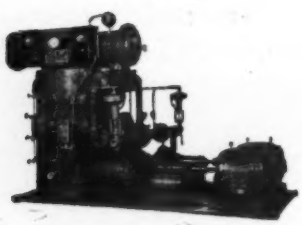
The Stickle Moisture Control System automatically maintains the exact moisture content desired in all types of paper within ½ of 1%. It records or indicates moisture variation of the sheet and steam pressure in the dryers . . . restores proper moisture content after breaks up to 8 times faster than former methods . . . eliminates time-consuming hand adjustment of steam flow to dryers . . . cuts steam consumption . . . improves quality and reduces customer complaints. Get the facts in Stickle's Bulletin 360-C.

New Dryer Control Helps Prevent Picking, Curling and Cockling

Following successful operating tests, Stickle has introduced a new control that automatically maintains the best temperature on individual wet end dryers. The control improves finish, and helps prevent picking, curling and cockling on all types of paper. It consists of a thermostatic pneumatic pilot controller and diaphragm motor valve. A dial on the controller provides instant setting of any temperature desired. Temperature ranges are 50° F. to 250° F., or 150° F. to 350° F. Once the temperature has been set, the controller actuates the valve which responds quickly to meet the demand requirements of the dryers. Two types of controllers are available. The direct controller (illustrated) is attached to the steam joint on the back side of the machine. A remote controller may be located at any convenient place in the mill. Test results and new literature are available on request.

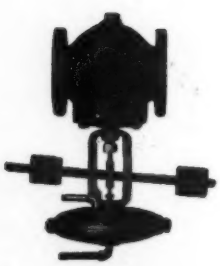


"X-Ray" view of the Stickle Open Coil Deaerating Feed Water Heater . . . guaranteed to heat more water to higher temperature in less space than any other heater at any price. Capacities: 3,000 to 300,000 pounds per hour.

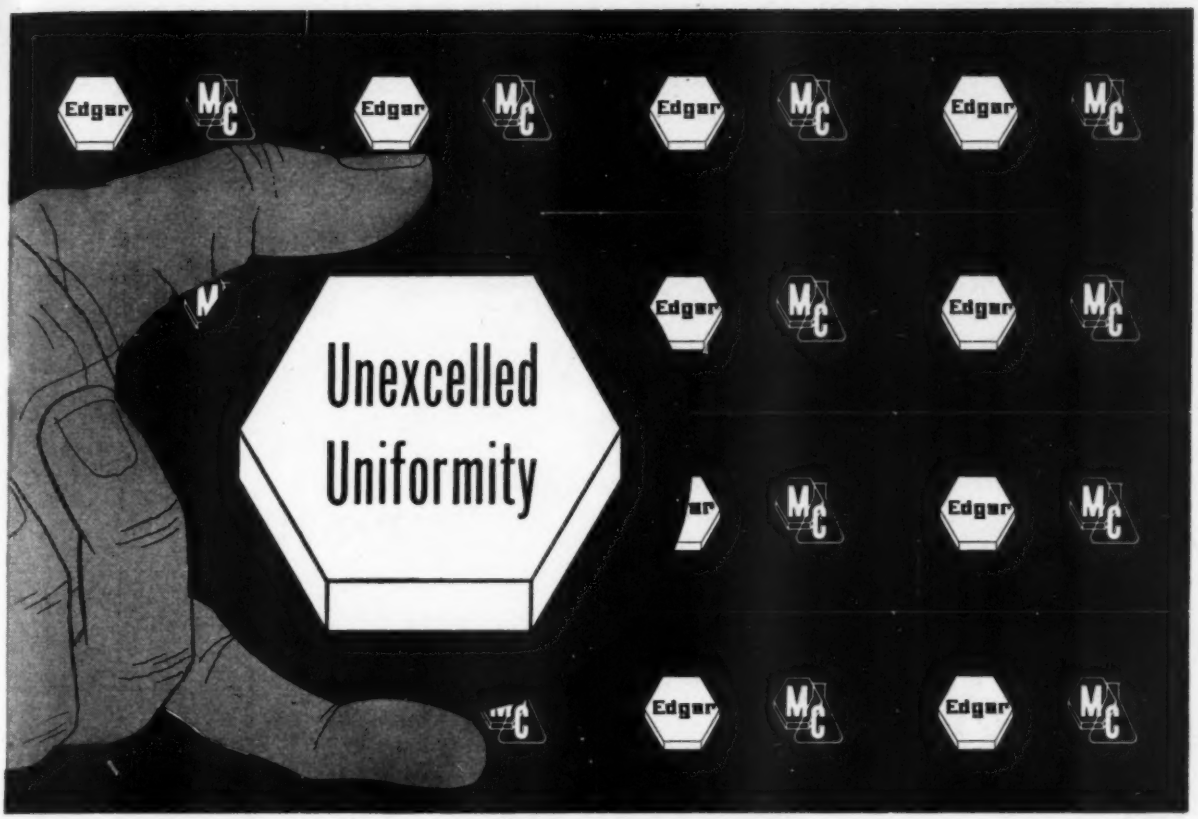


The Stickle Vacuum Pump is main unit of the Vacuum Differential Drainage System. Single and duplex models. Capacities up to 300 GPM (water) and 290 CFM (air); or 900 GPM (water only).

Stickle Visible Micro Adjustable Orifice permits accurate modulated temperature control on dryers with visible operation. Eliminates steam losses due to excessive "blowing through" into return lines.



Stickle Automatic Differential Valve controls exact differentials in pressure between two sections of paper machine, assuring proper drainage at all pressures.



...always yours in **Edgar Paper Clays**

Consistent Quality in Paper Clays is the solid record of Edgar Clay quality control procedures. Paper makers can and do depend on Edgar Product Standards *every time, every car, year in, year out.*

Put Edgar Clays to the Test . . . To insure yourself of the best possible raw materials, put Edgar Coating and Filling Clays to your own tests. Results? You will find that Edgar Clay quality stands out . . . not alone on high brightness, low moisture, controlled viscosity, and minimum residue . . . but even more important on *true uniformity* . . . that *added* quality to insure you consistently of highest sheet standards in your finished products.

We'll Help You Three Ways . . . (1) Serve you by supplying the paper clay exactly suited to your specific needs; (2) give you the benefits of the most modern processing and quality-control techniques; (3) help you—through products and service—to turn out the best papers modern technology can produce.

EXTRA DIVIDENDS...To help you select the product most suited to your requirements, there have been published full specifications and basic properties of all Edgar Coating and Filler Clays. A copy of this bulletin is yours for the asking. Please use the coupon below.

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- ☐ Basic Properties of Edgar Paper Clays.
- ☐ Other first-hand information and samples pertaining to:

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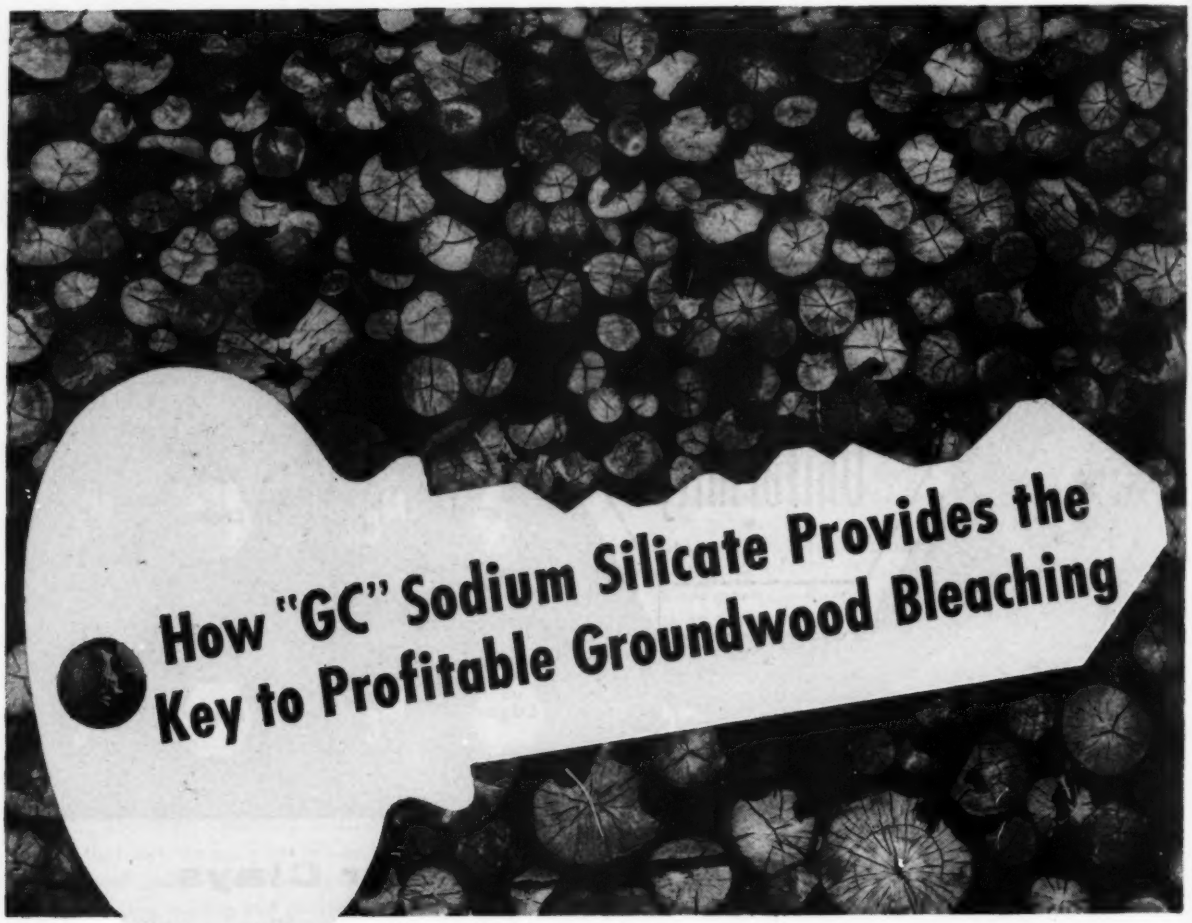

How "GC" Sodium Silicate Provides the Key to Profitable Groundwood Bleaching

Profitable production of white, clean-looking stock from groundwood pulp depends largely on the economical use of the peroxide bleaching agent. Economy is readily obtained by using sodium silicate in the bleaching solution. Used in proper proportions, it:

- **Stabilizes the peroxide bleach, which tends to decompose in aqueous solutions**
- **Aids in maintaining the proper pH**
- **Makes the maximum amount of oxygen available for bleaching by its action in inhibiting the decomposition of the bleach**
- **Helps protect equipment from corrosion by acting as a protective coating**

General Chemical's Sodium Silicate is ideal for this application, whether the bleaching chemical employed is sodium peroxide or hydrogen peroxide, or a combination of these peroxides. In addition, the assistance of our technical service specialists is always available to help you with problems involving use, storage or handling.

For further information on General's Sodium Silicate or any of the Company's other papermaking chemicals listed below, call or write the nearest office.

GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

40 Rector Street, New York 6, N. Y.

Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo • Charlotte • Chicago • Cleveland Denver • Detroit • Greenville (Miss.) • Houston • Jacksonville • Kalamazoo • Los Angeles • Milwaukee • Minneapolis New York • Philadelphia • Pittsburgh • Providence • San Francisco • Seattle • St. Louis • Yakima (Wash.)

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GC Allied Chemical

Basic Chemicals for American Industry

General Chemical Products Used For Papermaking—Aluminum Sulfate, Standard & Iron Free • Aluminum Sulfate, Liquid • Aqua Ammonia • Chrome Alum Copper Sulfate • Disodium Phosphate, Anhy. • Epsom Salt • Glauber's Salt, Crystal (Waste Neutral Salt) • Hydrochloric Acid (Muriatic) • Nitric Acid Salt Cake • Sodium Bisulfite • Sodium Metasilicate • Sodium Silicate • Sodium Sulfite, Anhy. • Sodium Thiosulfate (Hypo) • Sodium Tripolyphosphate Sulfuric Acid • Sulfur Dioxide • Tetrasodium Pyrophosphate, Anhy. • Trisodium Phosphate

"Here's What I Want from my Work"

that's the subject for the 9th BOLTON AWARD

The Papermaker says:

"Whatever your job or your position, you have many *wants* and *desires* you are working to achieve. Some are well known, but others are not. Let's have your ideas on 'Here's What *I Want* from My Work.'"

TEN NATIONAL PRIZES: $1,000, $750, $500 and seven of **$200** each.

OPEN to all pulp and paper mill employees in North America.

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MAIL your entry to: The Secretary and Treasurer, THE AMERICAN PULP AND PAPER MILL SUPERINTENDENTS ASSOCIATION, 327 So. La Salle St., Chicago 4, Illinois.

1500 WORDS or less, typed double spaced on 8½" x 11" sheets. Cover sheet only to include: name, mill, address and position.

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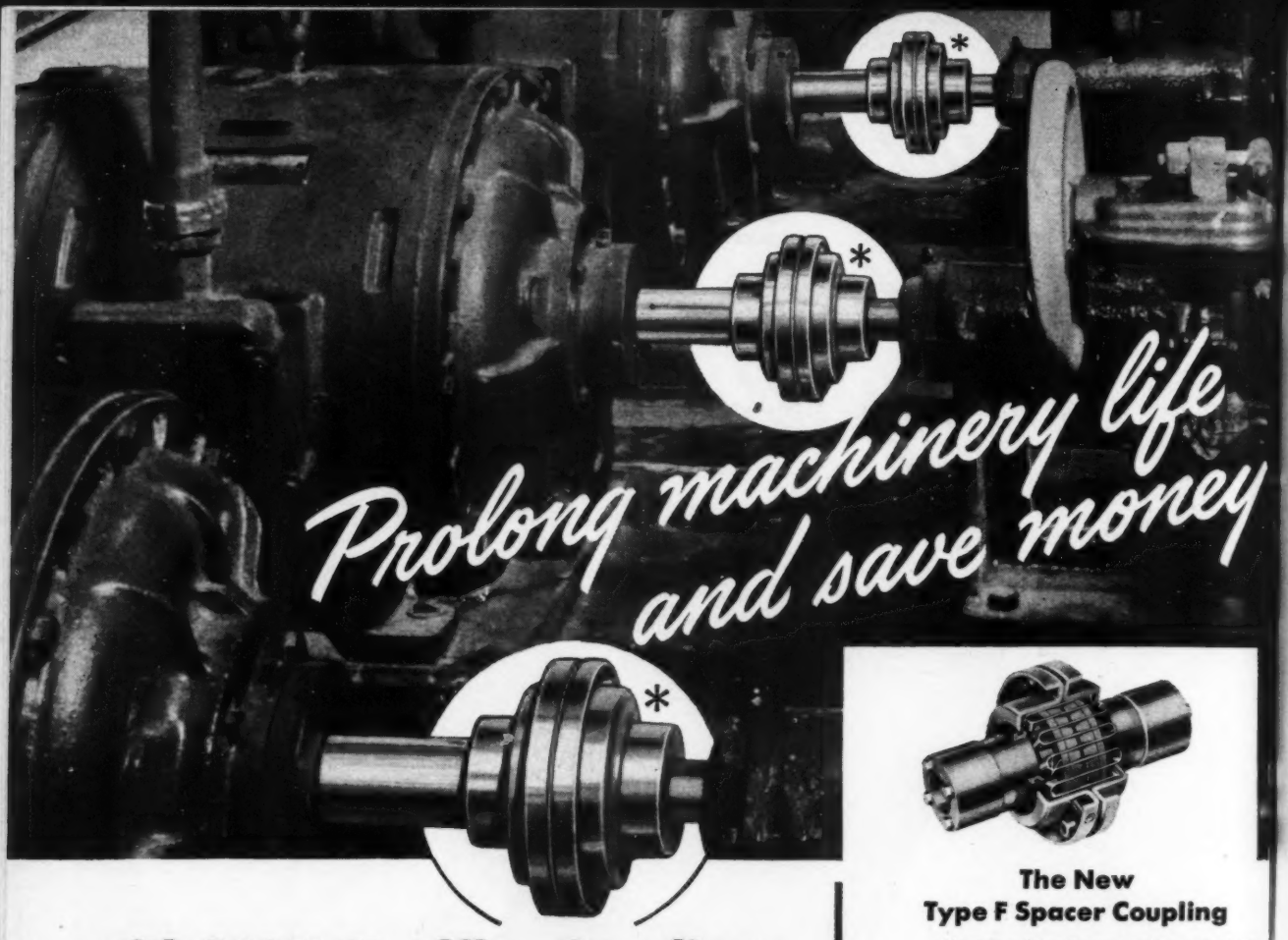

with FALK Steelflex Couplings

Ever since the first Falk Steelflex Coupling was designed and built, we have firmly held to these beliefs:

1. A coupling, to give fullest value, must do more than merely *connect* driving and driven machinery—it must *protect* the machinery and prolong its life.

2. A coupling, to be truly flexible, must overcome the effects of shock and vibration, as well as shaft misalignment.

Proof of the soundness of those beliefs is furnished by the record. More than one million Falk Steelflex Couplings have been used on every conceivable type of industrial application . . . giving trouble-free service, providing maximum protection to connected machinery.

* A single basic type—the famous Type F—fills 90% of all industrial application needs. It is versatile, efficient and economical. And—it is always available from factory, field or distributor stocks, in a wide range of sizes.

Write to Department 247 for engineering bulletin, including selection and dimension tables.

THE FALK CORPORATION, MILWAUKEE, WISCONSIN

MANUFACTURERS OF:

- Motoreducers
- Speed Reducers
- Flexible Couplings
- Shaft Mounted Drives
- High Speed Drives
- Special Gear Drives
- Single Helical Gears
- Herringbone Gears
- Marine Drives
- Steel Castings
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- Contract Machining

FALK

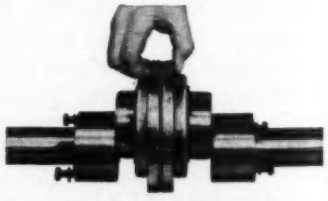
...a good name in industry

The New Type F Spacer Coupling

Here is a Steelflex coupling specially designed to permit fast, easy installation and removal in horizontal and vertical applications where it is impracticable to move the connected units—or where a space-gap (up to 12 in.) is necessary.

Like all Steelflex couplings, the Type F Spacer gives long, trouble-free service and maximum 3-way protection for connected machinery: it provides torsional resilience to reduce shock and vibration; it accommodates parallel or angular shaft misalignment; it allows free (or limited) end float.

An outstanding feature of the Steelflex Spacer is that it can be installed or removed in one piece (see photo below); no dismantling or servicing of the coupling is required. Pump assemblies can be disconnected and removed without disassembling the coupling, without exposing working parts.



The Steelflex Spacer coupling is prelubricated at the Factory and can be installed, or removed and reinstalled, without disturbing the lubricant—a highly desirable feature.

WANTED:

Your TOUGHEST Stock Pumping Jobs!

Radically new type of centrifugal pump now handles the most difficult stock solutions without clogging or air binding

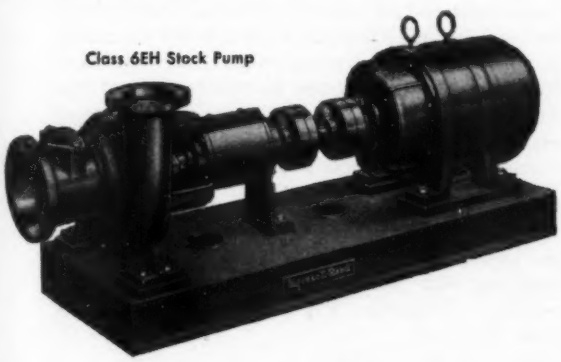
Not just a modified centrifugal pump, the new Ingersoll-Rand Class EL, EM and EH Stock Pumps feature a *radically new* and patented construction which makes them non-clogging, non-vapor-binding, self-venting and self-priming.

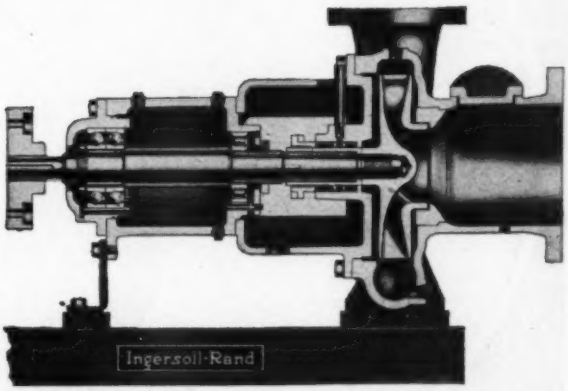
Paper stocks can be handled at concentrations as high as 10% without clogging. That means higher stock chest capacities, reduced bleaching costs and substantial savings in the amount of mill water required.

Treated, sized or foamy stock with up to 50% entrained air can be pumped without vapor binding or losing prime. Stock chests can be completely emptied without diluting or wasting the stock.

With *any* type of liquid, the pump will maintain its prime even when the suction piping is uncovered or exposed to the air.

Class 6EH Stock Pump





Section through Class 6EH pump, showing the patented construction

These heretofore unattainable performance characteristics result from the unique *diverging* impeller design in which the area at the exit is much greater than at the inlet. Hence the material pumped cannot enter in sufficient quantity to replace the ejected liquid and a vacuum space is created between the blades. Unlike the ordinary centrifugal pump, conversion from velocity to pressure is accomplished in the impeller as well as the casing and the relative velocities are considerably lower. This reduces impeller wear when handling liquids with high solids content.

Field experience with the new EL, EM and EH pumps has conclusively proved their ability to handle the *toughest* pumping jobs. In actual paper mill service, they are pumping stock solutions that no other centrifugal pump could handle without air binding or clogging.

If *you* have a stock moving problem that's too tough for an ordinary pump, this new I-R Stock Pump offers a practical, low-cost solution. Sizes available for capacities from 200 to 7000 gpm, heads to 225 ft. For complete details, send today for your copy of Bulletin 7325.

Ingersoll-Rand

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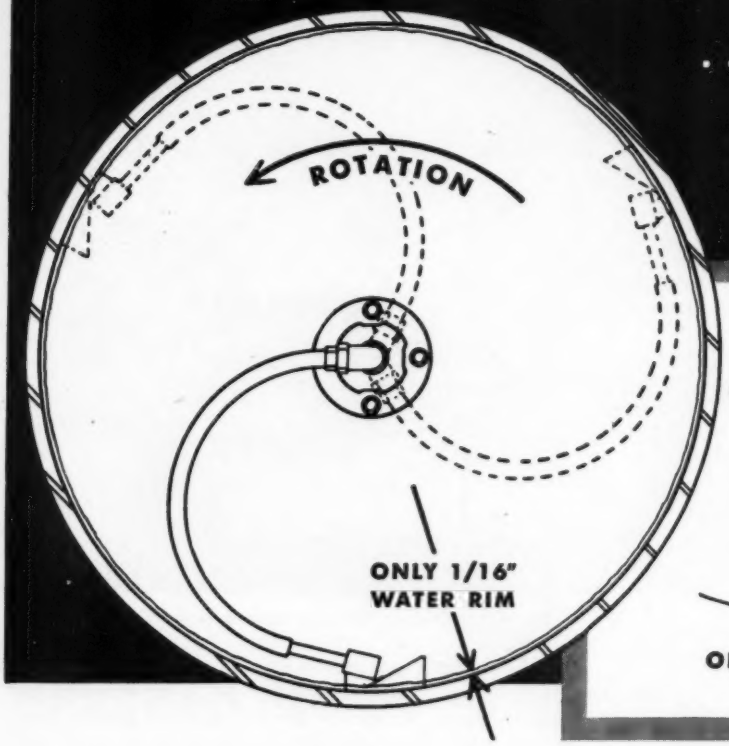
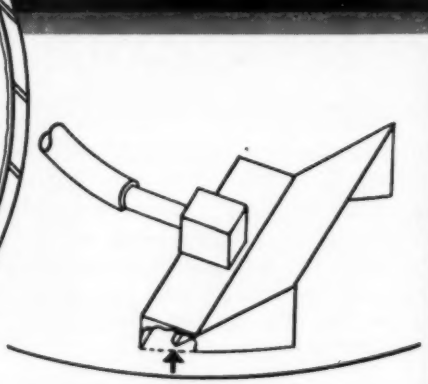
PUMPS • COMPRESSORS • CONDENSERS • VACUUM EQUIPMENT • GAS & DIESEL ENGINES • ROCK DRILLS • AIR & ELECTRIC TOOLS

HOW TO IMPROVE DRAINAGE OF HIGH SPEED DRYERS

. . . Use the NEW ARMSTRONG SYPHON SCOOP





Reduces Water Load and Horsepower Requirements — Improves Heat Transfer — Reduces Maintenance

● With the Armstrong Syphon Scoop you can get better drainage and greater efficiency from high speed paper machine dryers than was ever before possible. Until it was developed, there was no device that would work efficiently regardless of dryer speed. Those that worked best at high speeds failed at low speeds and vice versa.

At high speeds, stationary syphons or revolving syphons or scoops permit a rim of water to build up to depths of as much as ½" around the inside of the dryer shell. Heat transfer is reduced, the extra water load increases the power load and and cascading water often breaks stationary syphon pipes.

With the Armstrong Syphon Scoop the rim of condensate cannot exceed 1/16" in depth as shown in the diagrams above. At speeds below rimming, the generous sized scoop removes condensate as fast as it accumulates in the bottom of the dryer. As a result, superior dryer performance is secured at all times. Heat transfer is improved, horsepower requirements are reduced and there is no maintenance problem.

●

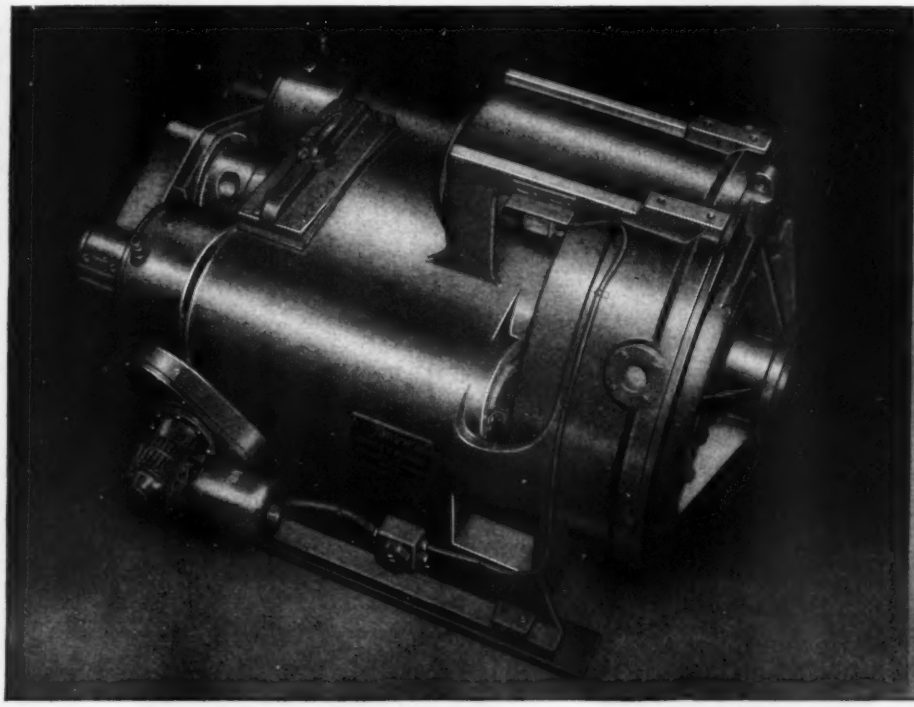
A COMPLETE DISCUSSION of this subject together with test data is available upon request without obligation. For more output at lower cost, write to:

ARMSTRONG MACHINE WORKS

816 Hoffman Street • Three Rivers, Michigan

Syphon Scoops—Dryer Drainage Traps
Moisture Control Systems—Steam Humidifiers
Individual Dryer Temperature Controls

DOUBLE-D WITH DOUBLE EQUA-FLO EFFECT



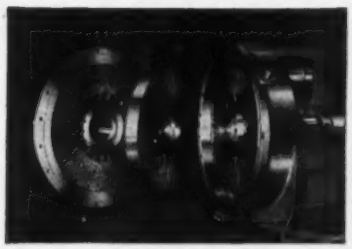
This overhead view illustrates the compactness of the Double-D. Very economical of floor space, it can be located and piped up in much the same manner as a conventional Jordan.

Consistently does the work of two or more conventional refiners . . .

You're looking at the new Jones Double-D Refiner . . first truly pressurized disc refiner — clean-lined, compact, easy to operate, easy to maintain . . . and already setting performance records.

For the Double-D is a *proven* machine. Full-scale production units have been in operation in several mills for as long as 18 months — and in fact several mills have already re-ordered.

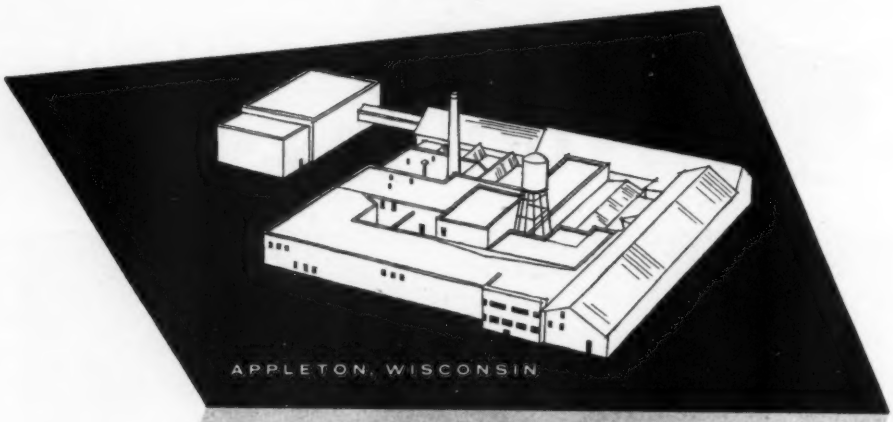
They report stock quality equal or better than any other refiners, with substantial savings in time, horsepower and floor-space. Ask your Jones representative for details or write for Bulletin No. EDJ-1083.



This "exploded" photograph shows the heart of the Double-D. Stock passing under constant pressure between two rotating and two stationary discs receives true two-pass refining . . . double effect.

Jones

BUILDERS OF QUALITY STOCK PREPARATION MACHINERY



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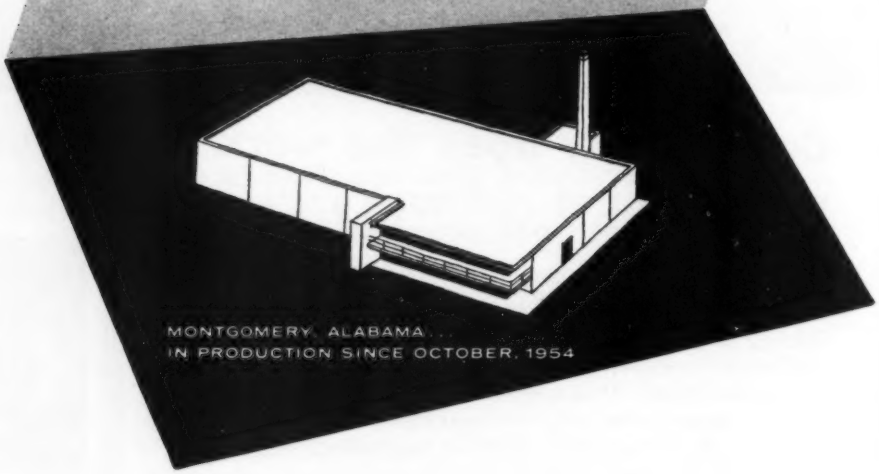
Confidence....in the paper industry

Foresight.....to anticipate changing conditions and requirements of the paper industry with new manufacturing facilities



MONTGOMERY, ALABAMA...
IN PRODUCTION SINCE OCTOBER, 1954

Appleton Wires are Good Wires

Appleton Wire Works, Inc.
GENERAL OFFICES, APPLETON, WISCONSIN

A WWW

INTERNATIONAL WIRE WORKS, MENASHA, WISCONSIN . . . AN AFFILIATED COMPANY SINCE JANUARY, 1955

If you use WAX...

...you'll want to use A-C* Polyethylene

How long have you looked for a way to get the outstanding values of polyethylene with the convenience of wax? And how many types of "poly" did you try before giving up?

Well, consider polyethylene again. But this time try *low-molecular-weight* A-C POLYETHYLENE –regular or emulsifiable!

Here's why:

- **handles at temperatures of wax in conventional equipment.**
- **gives a high gloss, enhances and adds richness to colors, improves scuff and abrasion resistance.**
- **is completely compatible with all waxes and actually fortifies all your wax formulations.**
- **permits close control of coating weight.**
- **easier to use, easier to handle. You can use higher percentages of A-C POLYETHYLENE on standard coating equipment.**

*Trade Mark

Don't delay! Commercial quantities are available for your immediate evaluation. Write for free samples today or return the handy coupon with your business letterhead.

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Allied Chemical

- ☐ Please send me technical literature on A-C POLYETHYLENE.
- ☐ Please send me free samples of A-C POLYETHYLENE.
- ☐ My proposed use of A-C POLYETHYLENE is:

Name_____

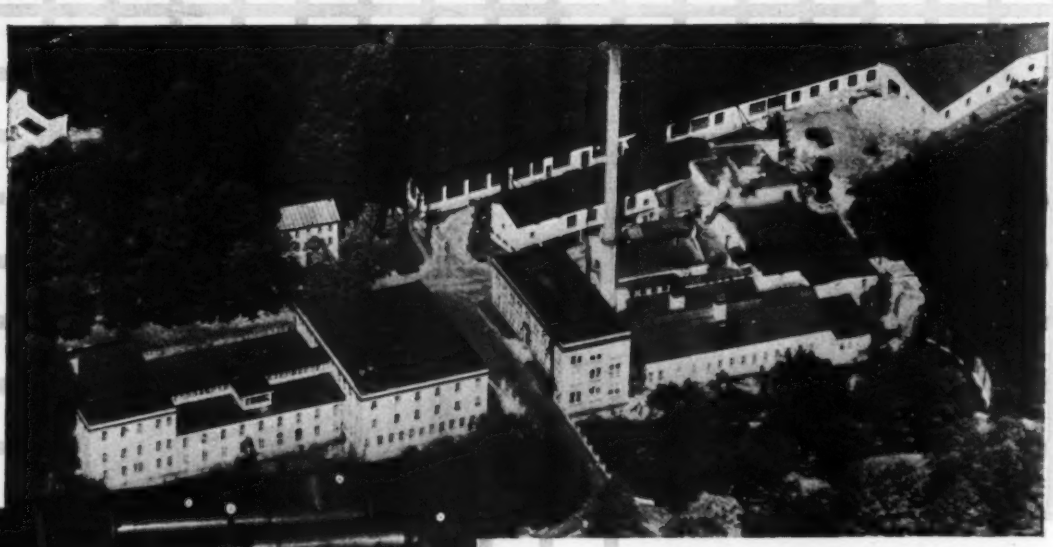
Title_____

Company_____

Address_____

City_____ State_____

Type of Business_____ PI-16



Plant of Chase Bag Company, at Chagrin Falls. Since 1848, producers of high quality kraft converting papers, including spinning, twisting, interleaving, and machine creped grades.

Bauer Pulp Cleaners at Chase Bag Company

Credits *BAUER CLEANERS* for cleanest kraft ever seen . . .

Sixteen Bauer Cleaners at Chase Bag Company Chagrin Falls, Ohio, are providing an extremely clean sheet.

"The Bauer Cleaners are doing a marvelous job," says General Manager J. A. Extrom. "I personally have never seen as clean a paper produced by any kraft mill as we have been making since the Bauer Cleaners have been in full operation."

General Superintendent Ralph Pierson states that, among other savings, wire life on their machines has been greatly extended by Bauer Cleaners' removal of sand and grit along with shives, bark, slivers, etc., from the stock.

Get the full story on Bauer Cleaners. Send for bulletin.

Bauer

THE BAUER BROS. CO.

1759 SHERIDAN AVE. • SPRINGFIELD, OHIO

Optimism Keynotes Industry's Outlook for 1956

DURING THE POST-WAR years the paper industry has undergone phenomenal growth in almost every phase of its operations. Millions of dollars have been devoted to expansion from coast to coast in both the United States and Canada. Many domestic firms have invested abroad. The general picture has been one of constant encouragement.

To sound out pulp and paper manufacturers on 1956 prospects, THE PAPER INDUSTRY contacted some of the leaders in the field—spokesmen for one of America's most vital industries. Representative reactions are listed herewith:

Alexander Calder

Thomas B. McCabe

Peter S. Paine

Alexander Calder, President and Chairman of the Board
Union Bag & Paper Corp.

The paper industry in the United States will have produced by the end of 1955 a record-breaking volume of around 29,500,000 tons of paper, paperboard and newsprint. Despite the strong demand for paper products which has obtained for most of this year, it is possible for the industry to repeat or perhaps improve on this performance in 1956.

To take care of the ever-growing demand both here and abroad, it is expected that during 1956 the over-all capacity in the paper industry will be increased approximately 1,500,000 tons to an annual total of around 32,300,000 tons.

Union Bag & Paper Corp. is looking forward with optimism to a continuance of good business in 1956. Many new types of bags and corrugated shipping containers are finding a widening acceptance with our customers, particularly in the non-durable goods field. Our stepped-up research program will result in an expanding number of new uses of kraft paper and board for packaging and other purposes.

Thomas B. McCabe, President
Scott Paper Co.

The workers and managements in most pulp and paper companies have reason to be proud of their accomplishments in 1955. The combine performances of all companies in the industry produced record-breaking results this year and on many sides we hear the expression "We're living in a paper age."

Present indications point to an even greater year in 1956 as better management methods and better trained personnel are available, numerous innovations in production and distribution are being brought forth, and more uses for paper are being found. Certainly the economic and political forces are favorable and conducive to expansion.

Rapid growth in the pulp and paper industry requires huge amounts of capital for modern high-speed paper machines and supporting equipment. A dynamic pulp-making technology demands constantly increased expenditures and the cost of woodlands is very substantial. Such capital outlays serve to increase the purchasing power of the users of paper products.

Fortunately, the securities of many paper and pulp companies now command broad public acceptance; so the cost of additional financial resources can be provided rather easily and economically. The strong financial situation in the industry today is quite a contrast to that of the 1930s, when securities of pulp and paper companies in general were a drug on the market. The securities of only a handful of paper companies were in demand for trust investments.

The pulp and paper industry has made extraordinary progress during the past decade and particularly in the past two or three years as the output per worker and the paper consumption per capita have risen. Until recently the scientific and technological development of the industry seemed to lag behind that of the electrical, chemical, automotive and oil industries. Now, however, the pulp and paper industry has begun to feel its tremendous latent power, and we are witnessing extraordinary activity in scientific research, mechanical development and even an accelerated interest in modern merchandising methods.

The industry has always been closely allied with the advertising field through the sale of paper to publishers and printing houses; yet, with the exception of a few companies, the industry generally has never attempted to merchandise its products to the extent that food, drug, chemical, automotive and electrical manufacturers have promoted theirs.

Now we see evidences of more companies joining the ranks of the few which have been applying modern merchandising techniques. Once the industry really begins effectively to interest the public in the products of pulp and paper through advertising and new merchandising methods, the potentialities for expansion will be limitless.

George Olmstead Jr., President
S. D. Warren Co.

Along with most other forecasters, I believe that 1956 will be an extraordinarily good year for the paper industry in general and for the book paper segment in particular—though I do feel that we shall probably have a somewhat stronger pressure in the first half than we have in the second.

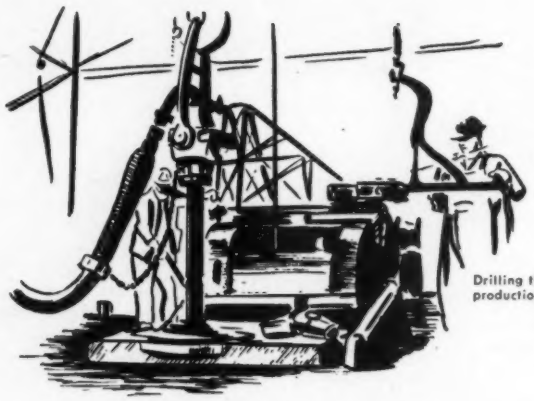
Nevertheless I would guess that shipments of book paper would average some 3 to 5 per cent higher in 1956 than in the record-breaking year 1955.

Looking ahead long-range, there are three areas which, it seems to me, become of growing significance—and which, for that reason, must be constantly and carefully watched by top management in our industry.

These three areas are:

1. The export market, which offers increasing opportunities for the domestic manufacturer of staple, mass-produced, no hand-work high-pulp content products.
2. The domestic wood supply, which can be stretched to meet future needs only by widespread education of the owners of "farm wood lots."
3. The cost-price relationship, wherein the margin must be sufficient to retain and attract capital to finance such plant expansion as will be necessary to meet the needs of a growing American economy.

(Continued on Page 923)



Drilling the production wells

Crude Sulphur

for Industrial Use

from the properties of

Texas Gulf Sulphur Co.

75 East 45th Street • New York 17, N. Y.

Producing Units

- **NEWGULF, TEXAS**
- **MOSS BLUFF, TEXAS**
- **SPINDLETOP, TEXAS**
- **WORLAND, WYOMING**

Industry Optimistic (Cont'd.)

P. H. Glatfelter III, President
P. H. Glatfelter Co.

Our sights for the first six months of 1956 are set at a moderately higher level from the paper demand standpoint than was true of the first six months of this year. For the second six months, we believe that the demand will somewhat level off and perhaps will be closer to the last half of 1955.

From a production standpoint, we expect the first half of 1956 to be about the same as 1955, at which time we operated at 115 per cent of capacity. During the second half of 1956 we expect to have additional capacity coming into operation and, as a result, should produce moderately more paper.

David L. Luke Jr., President
West Virginia Pulp & Paper Co.

Such knowledge as is available to me would seem to indicate great underlying strength in our industry for the next six months. It would seem as though the strength of our industry's position should be great enough to offset such minor economic corrections as may occur in the second half of 1956.

Ours is a growth industry. Economic corrections attributable to political uncertainties or to inventory corrections are likely to be largely absorbed by existing growth trends. This has happened quite recently. The general economic decline of 1954 was fully aborbed by our industry, as indicated by the fact that production for the year was slightly larger than the record year of 1953.

It looks now as though production for 1955 should exceed that of 1954 by more than 3,000,000 tons, and as though the industry should approach a record round number of 30,000,000 tons. If my crystal ball portrays a reasonably accurate picture, 1956 should again approximate the 30,000,000 ton level.

John Stevens Jr., President
Marathon Corp.

Marathon Corp. experienced a 1955 net sales increase of 14.9 per cent over 1954. We expect continued sales growth for two reasons.

First, packaging customers and consumers who use our retail products are increasing, both in numbers and in size. Further, modern methods of merchandising food products, with emphasis on self-service selling, require more packaging with high sales appeal.

In addition, our planned program of capital expenditures for additional plants and equipment will permit us to correspondingly increase our sales volume.

With per capita consumption of paper and paperboard products reaching a new high of approximately 415 pounds in 1955, new uses, plus a high level of activity in other industries, will require more production from the pulp and paper industry. It is my expectation that, barring a major economic reversal, which I do not foresee, new goals in both production and sales will be reached by the industry as a whole.

John E. Alexander, President
Nekoosa-Edwards Paper Co.

We have every reason to expect continued prosperity in the paper industry. The accelerated population growth combined with the business confidence generated under the present administration and other economic factors led us to believe that a normal demand of our papers will continue well into the new year.

The strengthening of our internal organization and production facilities plus stepped-up emphasis on sales and distribution efforts are all based on expectations of a favorable year for business.

Robert Faegre, President
Minnesota & Ontario Paper Co.

Demand for Mando-made paper, wood fiber board and other forest products is expected to continue during 1956. Forecasters indicate newsprint requirements will be somewhat larger during 1956 as compared with 1955, and the demand for other paper products may generally exceed available production.

With national business activity reflected in expected new highs for gross national product and disposable personal income, Mando expects to run its mills at full capacity during the coming year.

To meet anticipated increased demand for forest products, Mando will continue to accelerate its expansion and diversification program. By 1957 the company's rated capacity of newsprint is expected to be increased by some 85,000 tons annually, and the rated capacity for specialty papers will correspondingly be increased in excess of 25,000 tons.

Peter S. Paine, President
New York & Pennsylvania Co. Inc.

The word "forecast" is always one I try to avoid especially on matters involving our industry—so I'll not attempt to interpret the estimates on advertising volume, magazine circulation, direct mail, and all the other factors that affect our sales and book paper consumption in general.

At the same time, one cannot be associated with a 65-year-old company which produces a half billion pounds of paper a year without planning not only for 1956, but for the next decade. For that period, we plan to continue our growth by expanding and improving our mills at a rate that will exceed even that of the past ten years.

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The Paper Industry

JANUARY 1956

Continuous vs. batch pulping

The annual pulp and paper conferences held at the University of Florida focus on specific problems in the pulp and paper industry. These problems are both timely and indicative of the direction in which major developments in the industry may be expected. It is this focusing on definite objectives and the skillful blending of current requirements with those of tomorrow that give these conferences their spark and their impact on the industry.

This year's conference, the papers of which are published in this issue, constituted a comparative analysis of problems pertaining to batch and continuous alkaline pulping and brought out the strong points and also some of the weaknesses in both.

W. J. Nolan, in "Theoretical Considerations of Rapid Continuous Pulping," presents new evidence for the moving interface mechanism of pulping (first published in the May, 1955, issue of THE PAPER INDUSTRY) and interprets the variables of rapid continuous pulping from the standpoint of this mechanism. Dr. Nolan's paper is filled with new results that will have a far-reaching effect on the industry.

Westvaco's experiences with continuous pulpers and the progressive improvements made by the company on these pulpers are cogently reviewed in a paper by James M. Loving.

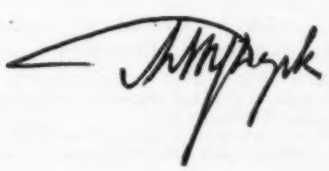
Discussing new developments in digesters and digester techniques, Lee Eberhardt describes the Rapid Cycle and Bauer-Grenco continuous digesters, both of which already are showing outstanding performance in actual operation. An interesting possibility is indicated of combining the two to use the Rapid Cycle digester for impregnation of chips and the Bauer-Grenco unit for continuous digestion.

The effect of the principal variables in kraft pulping, as applied in both continuous and batch pulping, is discussed by M. N. May to show the importance of establishing the best combination of pulping for optimum pulp properties.

The practice of using a high initial active alkali concentration with reduced cooking time and extremely low sulfidity to produce strong batch-cooked pulps at Southland Paper Mills is described in a paper by Fred W. Bishop. Finally, in the batch pulping series, a detailed description of the production and properties of high-yield kraft pulp at Bathurst Power & Paper Co. is given by J. McK. Limerick.

While continuous pulping is definitely on the way in, it is also apparent from these papers that batch processes can be modified and operated at considerably improved levels of performance. Even with all the advantages of a continuous pulping system, it is therefore not recommended that the mills promptly discard their present batch digesters in favor of the continuous units. What we do recommend, however, is that the mills thoroughly familiarize themselves with problems of continuous digestion, so that, if and when a continuous system is installed, it may be put into operation with a minimum of difficulties.

Since the papers in this conference series incorporate a remarkable wealth of know-how and experience in both batch and continuous pulping, we present them to our readers with the conviction that they will serve in an enhanced measure the interests of the pulp and paper industry.



Theoretical considerations of rapid continuous pulping

By W. J. NOLAN*

IN ANY DISCUSSION of continuous pulping one must define which of two general methods of treatment is under consideration. In one method, the Kamyr process, the cooking cycle is quite similar to that of modern batch pulping. The same maximum cooking temperature, 345 — 350° F., is used. A definite period is allowed for chips and liquor to reach maximum temperature, and a total cooking time in the same general range as for batch cooking is used. Digesters are large, about 6 ft. in diameter by approximately 65 ft. high.

In the second, or rapid, method of continuous pulping, as illustrated by the Fandia, American Defibrator, Medura, etc., the accent is on speed of pulping. The cooking cycle is in the range of 30 min. In order to carry out the same degree of delignification in such a drastically shortened reaction time it is necessary to alter the cooking variables to accelerate the delignification reaction. In all cases, the period of rising temperature is eliminated, the digesters operating at constant steam pressure. Further acceleration in pulping is accomplished by increased cooking temperature and either liquor concentration or liquor-wood ratio.

Before such changes as elimination of the period of temperature rise, increased cooking temperature and increased alkali usage are put into effect, one should know the effect of such changes on quality and yield of the resultant pulp. The most dangerous of these changes is the elimination of the period of rising temperature. If the penetration theory is correct, the period of increasing temperature is vital to satisfactory pulping. This theory requires that the cooking liquor penetrate the chip thoroughly before the actual delignification reaction becomes significant.

The physical mechanism of pulping—liquor penetration vs. surface reaction

When continuous pulping studies were first undertaken at this laboratory in 1950 it was found almost immediately that pulps from mill size chips were seriously degraded by drastic cooking conditions. The general shape of the screenings from these severe cooks indicated that, perhaps, penetration of liquor was not preceding the cooking reaction. The screenings retained almost all of the original chip length in the grain direction, becoming increasingly thinner transversely to the grain. It was reasoned that, if the chips were processed to a slim condition similar to these screenings, the cooking process might be improved. This was the start of the present methods of chip shredding used in this laboratory. During the past several years evidence has been accumulated which indicates that the old penetration theory is incorrect and should be replaced by a theory of surface reaction. That is, chemical and lignin react initially at the chip surface. As lignin is partially removed from the fibers, channels are opened up, through which fresh alkali can reach the inward moving interface between liquor, and wood and products of reaction can diffuse outward to the main liquor body.

A logical examination, based on the physical structure of wood, of the mechanism required by the penetration theory of pulping would seem to indicate that such a mechanism would be most inefficient. The only way in which the cooking liquor can penetrate the whole chip is through the lumens of the fibers. As liquor from the outside enters the lumens of the fibers cut by the chipper knives, it rises through these lumens by capillary action. Travel from one lumen to another is accomplished through the bordered pits. Since the lignin in the middle lamella is relatively non-porous it is not in contact with the liquor when penetration is complete, except at the outer surfaces of the chip and, possibly, at the bordered pits. Cellulose of maximum purity at the inner layer of the fibers is in intimate contact with the cooking chemical. As soon as temperature is increased to a point where delignification can occur, a reaction between cellulose and alkali will take place. In order for alkali to react with lignin in the middle lamella it must diffuse through the porous cell wall. Products of delignification, much more viscous than the original alkali, must diffuse back through the cell wall and out through the lumens and bordered pits. It does not seem that such a mechanism can explain almost complete delignification and recovery of most of the cellulose without excessive degradation.

Proponents of the penetration theory have suggested that chips be completely filled with cooking liquor, followed by removal of excess liquor and finally bringing the soaked chips to the pulping temperature. A simple calculation, based on reasonable assumptions, shows the concentration of chemical needed for this process. The assumptions are as follows.

1. **Chips, after complete absorption, will contain 33 per cent O.D. wood.**
2. **The pulping reaction requires 0.250 gm. Na_2O per gm. of wood substance dissolved. (This figure has been verified approximately by several investigators.)**
3. **At least 20 per cent excess over the minimum alkali should be used. Such an excess would correspond to the use of 15 per cent active alkali.**
4. **The original chips contain 40 per cent moisture.**
5. **Chips will be cooked to 50 per cent yield.**

Basis of calculations: 100 gm. O.D. wood.

Wgt. of original wet chips $= \frac{100}{0.60} = 166.7$ gm.

Wgt. of chips after penetration $= \frac{100}{0.33} = 303$ gm.

Liquor pickup $= 303.0 - 166.7 = 136.3$ gm.

Wgt. Na_2O required $= 100 \times 0.50 \times 0.25 \times 1.20 = 15.0$ gm.

Concentration of cooking liquor required (at a sp. gr. of 1.10) $= \frac{15 \times 1000 \times 1.10}{136.3} = 121.0$ gm. Na_2O per liter.

Average concentration within the soaked chip (sp. gr. $= 1.08$) $= \frac{15 \times 1000 \times 1.08}{136.3 + 66.7} = 79.8$ gm. Na_2O per liter.

These concentrations appear to be excessively high and might cause excessive degradation as the temperature

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*Paper presented at the Fourth Annual Pulping Conference, University of Florida.

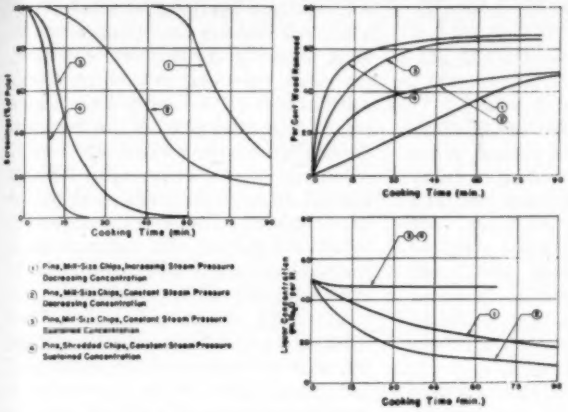


Fig. 1—Effects of pulping variables on the cooking of slash pine

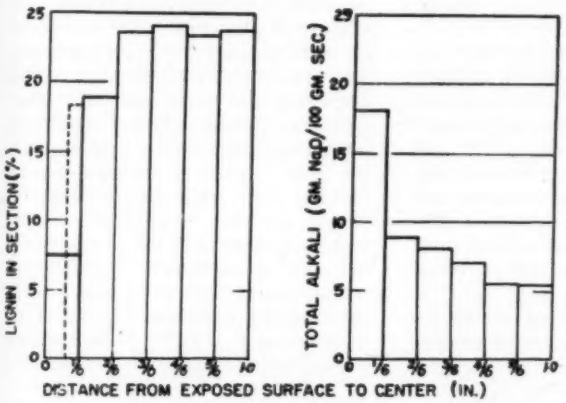
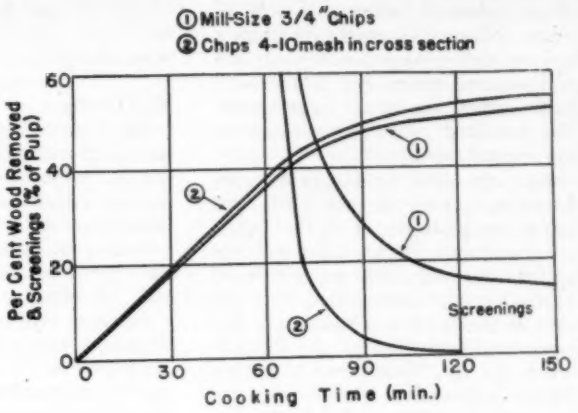


FIG.3 LIGNIN & ALKALI GRADIENTS IN KRAFT PULPING.
WOOD SIZE - 2" CUBES.
LIGNIN IN SECTION (%)
TOTAL ALKALI (GM. Na2O/100 GM. SEC.)
DISTANCE FROM EXPOSED SURFACE TO CENTER (IN.)


① Mill-Size 3/4" Chips
② Chips 4-10mesh in cross section
Per Cent Wood Removed & Screenings (% of Pulp)
Screenings
Cooking Time (min.)

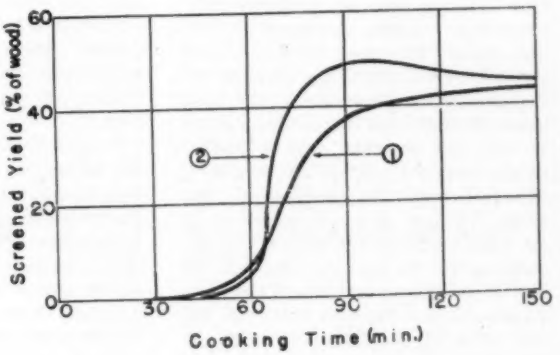
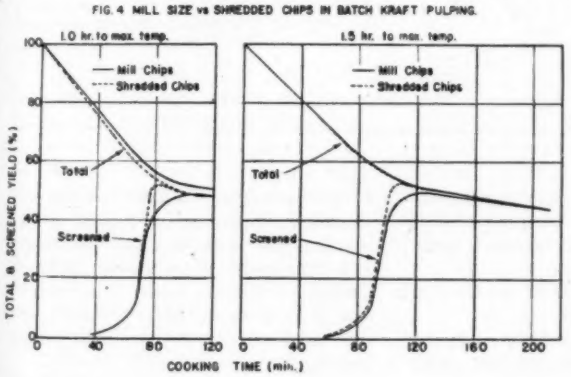


Fig. 2—Effect of chip size in batch kraft cooking. Chips were shredded in the hammer mill without presteaming



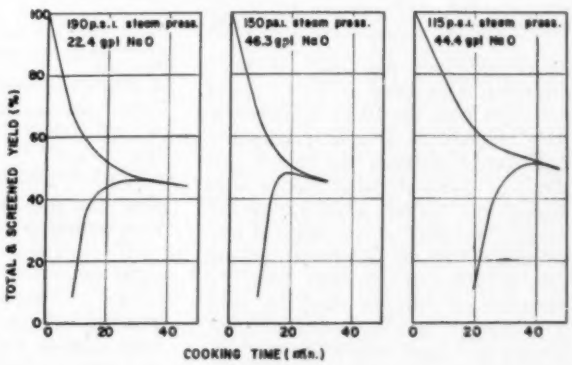


FIG. 5 HIGH SPEED PULPING OF SLASH PINE.
190 p.s.i. steam press.
22.4 gpl Na2O
150 p.s.i. steam press.
46.3 gpl Na2O
115 p.s.i. steam press.
44.4 gpl Na2O
TOTAL & SCREENED YIELD (%)
COOKING TIME (min.)

is raised. The high initial concentration should also result in a pulp of low pentosan. If lower concentration of liquor is used there is danger of complete chemical consumption by the reaction, with resultant low pH and lignin precipitation.

Several experiments at this laboratory indicate that the penetration theory should be replaced by a theory of surface reaction and an inward-moving liquor-wood interface. In the first of these experiments, four series of slash pine cooks, previously reported, were carried out under the following conditions.

The shredding of chips, in this case, was accomplished by softening kiln-dried chips by 10 min. contact with

Series No.	Condition of Wood	Initial Liquor Conc. gm. Na_2O per L.	% Alkali gm. Na_2O per 100 gm. O.D. Wood	Max. Steam Press. p.s.i.g.	Time to Max. Press. Min.
1	Mill chips	50.4	16.2	115	60
2	Mill chips	50.7	16.0	115	0
3	Mill chips	49.9	192.5	148	0
4	Shredded chips	50.0	192.5	148	0

dilute carbonate solution at 170-psi steam, followed by passage through a hammer mill equipped with ½-in. expanded metal screen. Fig. 1 shows the yield curves for these experiments. The tabulated data can be found in the original report (1).

First, the yield, screenings and concentration curves for the batch type cooks, designated by 1 in the figure, bring out some discrepancies with the penetration theory. The per cent wood removal curve shows that 36.4 per cent of the total wood substance had been dissolved during the 60-min. warm-up, or "penetration", period. This initial removal constitutes 66 per cent of the total wood dissolved in the total cooking time of 3½ hrs. The screenings curve indicates that throughout the cook there was a gradual conversion of the chips to individual fibers. These fibers must have been released from the outside surface of the chip remnant. Lignin content of the screened pulp produced during this first hour of "penetration" was about 14 per cent as compared to 27.5 per cent in the original wood. Analysis of the cooking liquor at the end of the first hour showed that concentration had dropped from the initial value of 50.4 down to 21.8 gm. Na_2O per liter. This consumption of chemical,

$$16.2 - \frac{16.2}{50.4} \times 21.6 = 9.27 \text{ gm. } Na_2O,$$

corresponds to $\frac{9.27}{36.4} = 0.255$ gm. Na_2O consumed per gram of wood dissolved. This value of 0.255 agrees very well with the alkali consumption ratio reported by several investigators and should discount the theory that alkali is absorbed rather than reacted during the initial warm-up period. Further, no part of the drop in concentration can be attributed in this case to diffusion of alkali from the concentrated solution into the chip. The original chips had been kiln dried, leaving no liquid water phase in the chip into which alkali could diffuse.

The cooking curves for the second set of experiments, in which the temperature rise period was eliminated, are designated at 2 in Fig. 1. As expected, an increase in reaction rate and chemical consumption occurred. Even though the rate increased, the chemical consumption ratio remained substantially the same as in the first set of experiments. This consumption amounted to $16.0 - \frac{11.0 \times 11.5}{50.7} = 12.37$ gm. Na_2O per 100 gm. wood charged, or $\frac{12.37}{45.3} = 0.273$ gm. Na_2O per gm. of wood dissolved.

The data indicate that the elimination of the temperature rise or "penetration" period did not cause excessive loss of cellulose and pentosan. The data show that,

with 1 hr. penetration, tot. yield = 48.0 per cent, screenings = 9.5 per cent, tot. time = 150 min.

without penetration, tot. yield = 48.0 per cent, screenings = 10.0 per cent, tot. time = 113 min.

If the elimination of the warm-up period had caused excessive degradation, the ratio of screenings to pulp would have been higher than for the milder cooking conditions. Elimination of the warm-up period resulted in a 24.6 per cent reduction in cooking time.

It was apparent from the first two sets of experiments that the combination of steam pressure and liquor concentration were not sufficiently drastic to produce excessive degradation. In the third series of experiments, sufficient liquor was used to insure substantially constant concentration during the cook. At the same time, steam pressure was raised to 148 psi to insure rapid pulping.

The curves show that at 48 per cent yield the screenings amounted to 27.0 per cent. The screened pulp was 48 (1 − .27) or 36 per cent. Therefore, the accelerated cooking conditions caused a loss of screened pulp equal to $\frac{(48.0 \times 0.90 - 36.0)}{48.0 \times .90} \times 100 = 16.7$ per cent of the screened pulp realized from the milder conditions. The cooking time required to reach 48 per cent total yield was only 20 min., as compared to 150 min. in the first set of experiments. From these results it is apparent that, as the centers of the chips were being delignified, pulp produced earlier from the outside of the chip was being dissolved. The excessive loss of cellulose was caused by the chip size, which presented too long a path of travel for the reaction interface.

The fourth set of experiments, in which the chips were shredded before cooking, bears out this last statement. All cooking conditions were the same as in the third series. However, the chip cross-sections were much smaller than in the third series. As a result, at a total yield of 48 per cent (requiring 12 min. cooking time), screenings were 8.5 per cent. This is equivalent to a screened yield of 48 (1 − 0.085) = 43.9 per cent, which is about equal to the screened yield realized under the mild conditions of the first series of experiments.

It would appear, from the above discussion, that chip size should be adjusted to fit the cooking conditions. Decreased chip size is equivalent to increased surface area. Therefore, surface area must be increased as the cooking conditions become more drastic.

Carrying this reasoning further, it becomes interesting to evaluate the effect of this increased chip size under the mild cooking conditions normally used in commercial practice. This evaluation was carried out in another series of experiments, which have been previously reported (2). In these tests, dry pine chips were shredded in the hammer mill, without presteaming. These shredded chips were cooked under the same mild conditions as the first series of cooks described above. A comparison of the cooking curves for the shredded wood and mill size chips is shown in Fig. 2. From these curves the following results were obtained:

Type Chips	Cooking Time (hrs.)	Tot. Yield	Screened Yield % of O.D. Wood	Screening % of Pulp
Mill size	2.5	48.0	43.4	9.5
Shredded (4-10 mesh)	1.5	50.4	48.4	4.0

From these data it is apparent that the shredded chips can be cooked in 40 per cent less time than mill size chips, and the yield of screened pulp is $\frac{(48.4 - 43.4)}{43.4} \times 100 = 11.4$ per cent higher.

If the penetration theory of pulping were valid there should be no difference in the screened yield since sufficient time was allowed for penetration into the full-size chip. Actually it appears more logical to assume that the alkali is eating its way from the outside of the chip toward the center, providing a moving reaction interface. As this interface moves toward the center it leaves behind partially delignified fibers. The degree of delignification of the fibers from the outer edges of the chip, when the interface has

reached the center of the chip, will depend on the size of the chip. The larger the chip, the longer will some purified fibers be in contact with hot alkali, causing at least partial solution of cellulose. This explanation accounts for the decreased screened yield from the large chips.

A doctor's dissertation carried out in this laboratory (3) brought out further evidence supporting the theory of surface reaction. Large blocks of slash pine, 2-in. cubes, were cooked for 60 min. at a constant temperature of 190° C. A large excess of cooking liquor was circulated around the wood, insuring a constant concentration of 90 gm. Na_2O per liter at a sulfidity of 25 per cent. The cooked block was split along the grain into halves, and each half was further subdivided into six sections. The six sections from one half of the block were thoroughly extracted with hot water, and the extract was titrated for total alkali, active alkali and sulfide. The extracted sections were dried, ground and analyzed for lignin content. The second half of the block was cut up into sections, 1 in. by 2/3 in. by 2/3 in., and used for microscopic examination. A sliding microtome was used to cut very thin sections for microscope slides. In the areas where delignification was nearly complete several slices had to be made before a few whole specimens could be obtained. The thin slices were stained with a 1.0 per cent solution of phloroglucinol and examined under the microscope. Color photomicrographs of representative samples were taken immediately after the examination.

The results of the lignin and alkali determinations are shown in Fig. 3. It can be seen that the total lignin content of the outside section contained only 7.5 per cent lignin, while the section next to it contained 18.8 per cent lignin. The lignin contents of the four inside sections were almost constant, averaging 23.6 per cent. The original dry wood contained 28.0 per cent lignin. It is obvious that this lignin removal in the inner slabs, $28.0 - 23.6 = 4.4$ per cent, was caused by reaction penetration in the two directions at right angles to the plane of the section. The lignin removal in the outer slab was $28.0 - 7.5$, or 20.5 per cent. The surface area for reaction on the outer section was $2 \times 2 + 4 \times 2 \times 0.1667 = 5.328$ sq. in., while the exposed surface of each of the inner slabs was $4 \times 2 \times 0.1667$, or 1.328 sq. in. Theoretically, the lignin removal in the outer slab should be $4.4 \times \frac{5.328}{1.328}$, or 17.7 per cent.

Considering the necessarily qualitative subdivision of the block into slabs and the nature of the analytical procedures, this agreement of 17.7 per cent calculated removal with the observed value of 20.5 per cent seems quite good. From these results it appears that the rate of travel of the reaction interface is about equal in the three directions. This is quite interesting when one considers that the fibers and their hollow lumens are lined up in one direction only. The general appearance of the block after cooking, softened approximately to the same depth in all three directions, also indicated that there was no greater reaction parallel to the grain than at right angles to the grain.

The photomicrographs showed definite evidence of a moving reaction interface. To a depth of 0.0985 in. from the outside surface it was impossible to obtain whole sections because the material had been reduced to individual fibers which fell apart on cutting. By exercizing patience it was possible to obtain a few sections at this depth. These sections showed a sharp boundary, on one side of which the specimen had been stained a red-brown color. On the other side of this boundary the specimen was stained a blue color, indicating the absence of lignin. The red-brown color gives no indication of the lignin concentration in the section, but the blue color shows definitely that lignin has been completely removed. Therefore, it is apparent that lignin has been completely removed to a depth of 0.0985 in.

Using this figure for reaction penetration, it is possible to correct the lignin gradient line in the outermost section (Fig. 3). Since the overall lignin content for the whole section, 0.1667 in. wide, is 7.5 per cent and there is no lignin in this section to a depth of 0.0985 in., the average lignin content in the lignin-bearing part of the section must be $\frac{7.5 \times 0.1667}{0.1667 - 0.0985}$, or 18.3 per cent lignin. This figure of 18.3 per cent is not quite correct since it is based on the assumption that the section is uniform in weight. The outer part of the section has lost considerably more wood substance than the inner part and the actual lignin content will accordingly be less than the 18 per cent calculated. However, it does show that there is a very sharp lignin gradient in the outer portion of the block. This corrected gradient is shown as the dotted section in Fig. 3.

The alkali gradient shown in Fig. 3 agrees quite well with the lignin gradient data. There is some discrepancy in the alkali concentration in the four innermost sections. The data would have been in greater agreement with the lignin data if these four values, ranging from 5.40 to 8.05 gm. Na_2O per 100 gm. of section, had been closer to a constant value. However, the alkali data do, in general, support the lignin gradient in indicating a moving reaction interface.

There have been additional indications which support this theory of a moving reaction interface but they cannot be included here. The experimental facts described above indicate that pulping is accomplished by the penetration of the delignification reaction toward the center of the chip, rather than a complete penetration of alkali followed by a more or less uniform delignification. Once this fact has been established, it becomes of prime importance to present the maximum possible wood surface for reaction, especially if very rapid reactions are to be carried out.

Methods for expanding wood surface

Whatever method is used to increase the surface area of the chips, it must be ascertained that the method does the least possible mechanical damage to the cellulose fibers. From a purely surface point of view, the reduction of the chips to wood flour in a hammer mill with a fine discharge screen would produce the maximum surface. This method would be useless for papermaking purposes since the physical entity of the fibers has been destroyed. If one takes advantage of the structural weakness of wood in the grain direction and confines the surface expansion to multiple splitting along the grain, the maximum of surface will be developed with a minimum of mechanical damage to the fibers. If all of the product from the splitting operation is as long in the grain direction as the original chips, then the least possible damage has been done to the fibers. Thus, the measurement, in the product, of the fraction of broken pieces shorter than the raw chips, becomes an indication of the degree of fiber damage.

This measurement has been used in this laboratory to determine the efficiency of the shredding, or surface expansion, of chips. A nest of Tyler standard screens, consisting of 2, 3, 4, 8, 10 and 16 mesh screens is used. The dried product of the shredding operation is agitated on the Tyler Ro-tap Testing Sieve Shaker for 15 min. It is essential that the agitating motion have considerable vertical component so that undersize material can

pass through the screen endwise. The screen fractionation should be a measure of fragment cross-section rather than length.

It has been found that practically all of the material which has been broken across the grain will pass through 10 mesh. Apparently the shredded wood which is too large in cross-section to pass 10 mesh has sufficient structural strength to prevent breaking from the impact of the shredder. Less than half of the material held between 10 and 16 mesh is broken across the grain, while all of the wood passing 16 mesh has been damaged.

Both swing-hammer and attrition mills have been used satisfactorily for the shredding operation. When a hammer mill is used, a ½-in. expanded metal discharge screen should be used. A ¾-in. screen will produce too coarse a product, while a screen finer than ½-in. results in excessive fiber damage. Punched plate discharge screens are not satisfactory because of their small percentages of free opening. It is imperative that the chips be held in the mill for as short a time as possible.

If an attrition mill is used both rotor and stator should be equipped with either toothed or pin type plates. Plate clearance should be high, so that most of the work of splitting is caused by impact between the chips themselves. The protrusions from the plates seem to function at least as much as conveying devices as for the actual impacts they provide to the chips. In this machine, the plate clearance is a function of both desired screen analysis of the product and rate of feed.

Numerous tests with both hardwoods and pine have shown that the chips can be shredded satisfactorily for 0.5 hp days per ton O.D. chips in the attrition mill. The power requirements of the hammer mill are somewhat higher.

Until about two years ago it was thought that a pre-softening of chips was necessary before shredding. Since climatic conditions in this area require that chips be air-dried for extended storage, the first experiments in shredding were carried out on these dry, hard chips. In passing through the shredder these hard chips became rounded at the ends and, because of their brittle condition, excessive breakage occurred. When the air-dried chips were softened by steaming in dilute alkali at 150 — 170 psi steam pressure for about 10 min., it was found that they shredded very satisfactorily. The surface area was much greater than would be obtained from simple splitting. The softened chips were so flexible that, in splitting, fiber bundles were partially pulled away from the split pieces. This brooming-out of the chip ends provided a somewhat porous condition and very great surface area. The softening operation, unfortunately, caused unavoidable loss in yield. In spite of providing an alkaline medium for heating, some hydrolysis occurred, dissolving material which might not have been lost in cooking.

In recent years pretreatment of chips has been abandoned, and the laboratory is shredding chips immediately after they come from the chipper. The more moisture in the chips, the more efficient is the shredding operation. The latest chipping technique uses a wider plate clearance in the attrition mill than had been used previously. Clearance is adjusted so that the final product will not contain over 3 - 4 per cent of material which passes 10 mesh. The product usually contains about 25 per cent of material larger than 3 mesh. This oversize is screened out and mixed with the full size chips being fed to the mill.

A detailed study of the effect of chip size on the strength properties of pulp (2) has shown that chips shredded after softening produce pulps somewhat stronger in tear strength but slightly weaker in bursting and tensile strength than pulps made from mill size chips. These characteristics were found to be true for shredded chips in the range between 4 and 10 mesh. Below 10 mesh, the sharp drop in tear strength indicated excessive mechanical damage to this screen fraction.

No data have yet been published on the strength of pulps made from various size fractions of wood shredded from green chips. Results indicate that chips shredded in the range between 3 and 10 mesh can be converted into pulps as strong or stronger in tear than when mill size chips are used. The bursting and tensile strengths are equal to those of pulps made from normal chips. Elimination of the slight hydrolysis characteristic of the pre-softening operation appears to have eliminated the weakness in burst and breaking length.

Effects of temperature, concentration and time on yield in rapid pulping

If complete pulping is to be carried out in the time range of about 30 min., it is obvious that cooking temperatures and liquor concentrations must be increased in order to bring about the necessary acceleration in reaction rate. Increasing the wood surface alone is not sufficient to bring about the desired speed of pulping. Wide ranges of temperature and concentration have been studied and their effects on pulping rate have been evaluated.

Previously published data (3) have shown that slash pine can be cooked in 20 min. to a total yield of 47.2 per cent (screened yield 44.2 per cent) by using the high temperature of 384° F. (190 psi steam pressure). A constant liquor concentration of 20 gm. Na_2O per liter was used at this temperature. At 115 psi steam pressure (347° F.) and a constant concentration of 80 gm. per liter, the same wood was cooked in 20 min. to 47.2 per cent total yield and 46.4 per cent screened yield. It can thus be seen that it is not necessary to increase both temperature and concentration drastically to achieve the desired speed of reaction.

High temperature and high concentration are both dangerous variables as far as pulp degradation is concerned. Examination of the data in the preceding paragraph shows that only 44.2 per cent screened yield was obtained from the 384° F. cook, while 46.4 per cent was realized at 347° F. It is apparent that more cellulosic material was dissolved during the cook at the higher temperature. This does not mean that 384° F. cannot be used. In order to use this high temperature successfully, either concentration must be raised or chip surface increased so that the time of contact at this elevated temperature is decreased.

When intermediate values of temperature and concentration were used in the experiments discussed above, a higher screened yield was obtained than when the combinations of high temperature-moderate concentration or moderate temperature-high concentration were used. For example, at 365° F. and a concentration of 35 gm. per liter, a screened yield of 48.4 per cent was realized in 20 min. It can, therefore, be seen that a careful analysis must be made for each pulping problem in order to arrive at the optimum combination of temperature, concentration and time.

In using high concentration as a tool to achieve high reaction velocity it must be borne in mind that strong alkali results in pulps of low pentosan. Increased temperature also has an effect in this direction but not nearly as marked as concentration.

Effect of the cooking variables on pulp viscosity

In all of the earlier work at this laboratory the main emphasis was on pulp yield, chemical analysis and physical strength. The nature of the physical strength tests makes pulp strength

a poor criterion of small differences in pulp quality. Therefore, a preliminary study of viscosity changes with variations in pulping methods has just been completed. These data are included in the present discussion.

Slash pine was pulped under normal batch methods and under simulated continuous conditions in which constant temperature was used. Both mill size chips and shredded wood were used in the batch type cooks. Only shredded wood was used in the constant temperature cooks. Shredding was carried out by passing green chips, about 40 per cent moisture, through the Rotapulper* at a plate clearance of 0.97 in. The shredded chips were screened on 3 mesh and 10 mesh screens, the product recovered between these two screen sizes being used for the experimental cooks.

The screen analysis of the mill size and shredded chips used were as follows.

Screen Mesh		Original Chips %	Shredded before Screening %	Chips for Cooking %
	+1	11.9	—	—
−1	+1.33	46.7	—	—
−1.33	+2	24.3	5.7	0.0
−2	+3	10.1	15.3	0.8
−3	+4	6.0	27.2	32.7
−4	+10	1.0	43.6	63.9
−10		0.0	8.2	2.6

The analysis designated as original chips is not correct. It is the analysis of the material from the chipper after passing through a 1 × 2 screen and being retained on 3 mesh. These are the chips which were cooked as mill chips. The chips converted into shredded chips were exactly as they came from the chipper, including both oversize and chipper fines. This accounts for the high value of 8.2 per cent of material smaller than 10 mesh in the shredded chips before screening.

The cooks were carried out in the laboratory digesters by methods previously described. Selected pulps were analyzed for lignin and pentosan by TAPPI methods. In viscosity evaluation the pulps were delignified with sodium chlorite and acetic acid. Viscosity was determined by the TAPPI 0.5 M Cu. En. method. Several pulps were evaluated for physical strength. Table I contains all cooking data, while physical strengths of pulps are listed in Table II.

Fig. 4 shows the relationships between yield and cooking time for mill size and shredded chips cooked under batch conditions. The following condensation shows the relative merits of shredded and mill size chips and the importance of time to maximum temperature.

*Registered trade mark, Jackson & Church Co.

Chips	Time to Max. Temp. hr.	Tot. Time to Max. Yield hrs.	Max. Screened Yield % of O.D. Wood	Viscosity at Max. Yield c.p.	Lignin in Pulp %
Mill size	1.5	2.00	49.7	41.46	8.1
Shredded	1.5	1.83	52.7	48.60	9.9
Mill size	1.0	1.83	49.0	40.87	7.2
Shredded	1.0	1.50	51.0	44.36	8.7

It should be noted that the cooking times for mill size chips are lower than normal, caused by the fact that the mill size chips were smaller than those normally obtained from the chipper. Shredded chips resulted in substantially increased yield of pulp with higher viscosity than the mill chips. These points, along with higher lignin content, indicate more uniform pulping. The shredding operation is much more beneficial than an increase in the time to maximum temperature.

The cooking curves for the pulps cooked at 190, 150 and 115 psi constant steam pressure are shown in Fig. 5. Data for 170 psi are not included because concentration was not high enough for the cooking temperature, as indicated by the screened yields and excessive cooking time. The curves in Fig. 5 indicate that increased yield can be obtained as steam pressure is reduced. However, this indication may be false.

The total yield curve for 115 psi indicates that considerably higher yield could have been obtained if the cooking time had been shortened to the range of 20 - 30 min. by the use of a higher initial alkali concentration. On the other hand, the very rapidly dropping total yield curve for the 150-psi cook indicates that this reaction should be slowed down somewhat by a decrease in concentration. A reduction in liquor-wood ratio would also be advantageous, causing a flattening of the cooking curve near the end of the cook. The 190-psi cooks indicate the need for a higher initial concentration, but lower liquor ratio. Such changes should make the reaction more rapid in the early stages, reducing cooking time, but retaining the flat curve in the later stages.

The viscosity data for the rapidly-cooked pulps indicate the faulty cooking conditions. The cook with the highest screened yield, No. 1724, also had the highest viscosity, 37.32 c.p., of all the maximum yield cooks. It would appear, from the viscosity data of this series, that 41.56 c.p. might be the maximum attainable if the proper concentration had been used. However, this is considerably lower than the best viscosity obtained at max. yield among the batch cooks, namely, Cook No. 1680, with a viscosity of 48.60.

Before discussing the physical data, the method of analysis used in the table should be explained. Seven pulps were evaluated for tear, burst and tensile strength. These strength factors were plotted against Canadian Standard freeness and average curves were drawn through the data points. From these curves, strength values at three common freeness values of 650, 450 and 250 were read for the seven pulps. The tensile strength values at 650 ml. freeness for the seven pulps were averaged. The algebraic value of the difference between each tensile value and the average for the seven pulps was determined and converted to a percentage deviation from the average. By using this per cent deviation it is possible, at a glance, to obtain a measure of the relative strength of the seven pulps. The same procedure was followed for the tensile values at 450 and 250 freeness.

Average deviations in burst and tearing strength were computed in a similar manner. As a further simplification, the per cent deviations at freenesses of 650, 450 and 250 ml. were averaged algebraically, resulting in a single deviation for each pulp in each strength factor. These averages are listed below, along with the viscosity values of the pulps.

Cook No.	Average of the % Deviations for Three Values of Freeness			Pulp Visc.
	Tensile	Burst	Tear	c.p.
1672	+ 0.30	+ 2.82	+ 4.33	41.5
1680	+ 8.00	+ 1.12	− 3.45	48.6
1700	− 0.26	+ 1.50	+ 0.04	44.4
1708	+ 5.07	+10.97	+ 2.26	40.9
1715	+ 4.16	− 0.01	− 3.26	27.4
1697	− 7.70	− 3.96	− 8.22	29.3
1724	−10.16	−11.06	+ 2.58	37.3

TABLE I—PULPING DATA FOR SHREDDED AND FULL SIZE PINE CHIPS

Cook No.	Type Chips Used	Cooking Liquor: Conc. (gm Na_2O per L.)	Cooking Liquor: % Chem. (lb Na_2O per 100 lb. wood)	Cooking Liquor: Liquor-wood ratio	Max. Steam Press. (lb per in.²)	Max. Temp. (°F.)	Cooking Time (min.): to Max Temp.	Cooking Time (min.): Total	Yield (% of Wood): Total	Yield (% of Wood): Screened	Screening % of pulp	Analysis of Pulp: viscosity, c.p.	Analysis of Pulp: D.P. No.	Analysis of Pulp: % Lignin	Analysis of Pulp: % Pentosan
1670							90	60	71.7	0	100.0				
1671							90	90	60.7	10.7	82.4				
1672	Mill	40.3	16.0	4.18	115	347	90	120	51.7	49.7	3.7	41.46	1742	8.1	
1673	Size						90	150	49.5	48.5	2.1	36.35	1675	4.4	
1674							90	180	46.7	46.3	0.9	33.12	1620	3.6	
1675							90	210	44.3	44.0	0.8				
1676							90	60	71.2	0	100.0				
1677	Shredded						90	75	66.5	0	100.0				
1678	−3 +10	41.5	16.0	4.06	115	347	90	90	59.3	15.1	73.6				
1679	Mesh						90	100	55.4	42.8	23.6	52.76	1900	11.3	
1680							90	110	53.5	52.7	1.6	48.60	1845	9.9	
1681							90	120	51.3	51.2	0.1	47.74	1835	8.4	
1698							60	60	62.7	6.1	90.3				
1699	Shredded						60	75	55.8	40.3	27.8	49.90	1864	12.2	
1700	−3 +10	40.8	16.0	4.12	115	347	60	90	51.6	51.0	1.2	44.36	1785	8.7	
1701	Mesh						60	100	49.9	49.8	0.3	42.62	1762	7.7	
1702							60	110	48.3	48.3	0.1				
1703							60	120	48.1	48.1	0.0				
1704							60	60	65.7	6.4	90.3				
1705							60	75	58.8	35.3	40.1				
1706	Mill	40.4	16.0	4.15	115	347	60	70	53.7	46.7	12.9	42.18	1752	9.9	
1707	Size						60	100	52.3	48.1	8.0				
1708							60	110	51.3	49.0	4.3	40.87	1734	7.2	7.6
1709							60	120	50.7	48.3	3.4	34.52	1633	6.0	
1710							0	15	55.3	39.6	28.6				
1711							0	22	51.8	45.0	13.3	30.48	1574	8.7	4.5
1715		22.4	26.4	12.00	190	384	0	28	47.7	46.2	3.4	27.42	1517	6.8	4.8
1712							0	30	46.8	44.6	2.7	23.29	1432	5.5	4.7
1713							0	37	45.5	45.2	1.0	18.48	1313	4.2	
1714							0	45	44.3	43.7	0.3				
1682							0	15	65.2	11.6	82.2				
1683	Shredded						0	22½	60.7	24.9	59.0				
1684	−3 +10	19.1	16.0	8.43	170	375	0	30	55.6	39.3	29.2				
1685	Mesh						0	35	55.8	42.2	24.2	39.63	1723	10.8	
1686							0	42	52.2	42.8	18.0	35.56	1690	9.6	
1693							0	15	63.8	15.9	75.0				
1694	Shredded						0	22	58.0	35.4	39.1				
1695	−3 +10	21.0	17.9	8.70	170	375	0	30	53.0	43.8	17.2	38.60	1707	10.1	
1696	Mesh						0	37	51.3	46.8	8.9				
1697							0	45	48.3	46.9	5.1	29.32	1550	6.4	
1716							0	10	63.7	12.6	80.2				
1717	Shredded						0	15	56.0	44.8	19.8				
1718	−3 +10	46.3	30.9	7.00	150	366	0	20	50.3	47.8	5.0	25.99	1488	7.2	3.8
1719	Mesh						0	25	47.7	47.0	1.3	22.11	1404	5.5	3.6
1720							0	30	46.3	46.0	0.6	19.02	1326	3.9	4.8
1721							0	20	61.5	12.5	79.8				
1722	Shredded						0	30	55.2	46.1	16.6	41.56	1742	11.6	5.3
1723	−3 +10	44.4	25.8	6.10	115	347	0	35	54.0	50.2	7.3	39.31	1720	10.1	5.6
1724	Mesh						0	40	54.5	52.7	3.1	37.32	1687	8.8	5.6
1725							0	45	49.8	49.3	1.1	32.08	1600		

TABLE II—PHYSICAL STRENGTH OF SLASH PINE PULPS

Cook No.	Can. Std. Freeness (ml)	Tensile Strength: Observed Value	Tensile Strength: Deviation from Avg. (%)	Bursting Strength: Observed Value	Bursting Strength: Deviation from Avg. (%)	Tear Strength: Observed Value	Tear Strength: Deviation from Avg.
1672	650	7620	+ 0.85	53.4	− 0.74	226	+ 7.62
1680		8260	+ 9.32	55.7	+ 3.53	205	− 2.38
1700		7400	− 2.07	53.9	+ 0.19	207	− 1.43
1708		8050	+ 6.54	65.8	+22.30	217	+ 3.33
1715		7900	+ 4.36	53.6	− 0.37	209	− 0.48
1697		7300	− 3.39	50.5	− 6.13	189	−10.00
1724		6360	−15.84	43.8	−17.58	215	+ 2.38
Avg.,	all cooks	7556		53.8		210	
1672	450	8350	− 0.05	61.6	+ 1.65	181	+ 4.02
1680		8980	+ 7.50	60.4	− 0.33	159	− 8.63
1700		8420	+ 0.79	61.9	+ 2.15	165	− 5.17
1708		8730	+ 4.50	69.1	+14.00	180	+ 3.45
1715		8850	+ 5.93	60.8	+ 0.33	166	− 4.59
1697		7650	− 8.43	57.5	− 5.12	159	− 8.63
1724		7500	−10.22	53.2	−12.20	181	+ 4.02
Avg.,	all cooks	8354		60.6		174	
1672	250	9060	+ 0.10	69.8	+ 7.56	151	+ 1.34
1680		9700	+ 7.17	65.0	+ 0.15	150	+ 0.67
1700		9240	+ 2.09	65.0	+ 0.15	159	+ 6.72
1708		9450	+ 4.18	62.7	− 3.39	149	0.00
1715		9250	+ 2.20	64.9	0.00	142	− 4.70
1697		8030	−11.28	64.5	− 0.62	140	− 6.03
1724		8650	− 4.43	62.7	− 3.39	151	+ 1.34
Avg.,	all cooks	9051		64.9		149	

In this tabulation there is a wide divergence in viscosity of the pulp, but there appears no correlation between these viscosities and the strengths of the pulps. In the first place, the divergence of the strength factors from the over-all average is not, in general, significant. The nature of the methods of testing physical strength is such that it is doubtful if two consecutive tests on the same pulp would check within 5.0 per cent. In order to make the above tabulation indicate the true differences in the pulps, it is felt that at least three complete sets of physical tests should be made on each pulp. Such evaluation would entail an excessive amount of testing time.

Some of the inconsistencies in the physical data should be pointed out. Pulp No. 1680 appears very slightly superior to 1672. Both pulps were prepared identically except that shredded wood was used in pulp 1680. The con-

(Continued on page 974)

Covington's experience with continuous pulpers

JAMES M. LOVING*

CONTINUOUS PULPING of hardwoods for 0.009-in. corrugating medium was started at Covington, Va., in the latter part of 1943. The first two pulping units, or "Chemipulpers" as they have been called, were built by Paper & Industrial Appliances. The feeding mechanism of these units consisted of a twin screw feeder and a plunger mechanism for forming a plug of chips and forcing them into the unit against the 150-psi operating pressure. This feed mechanism was very troublesome, causing numerous violent "blowbacks," in which the plug of chips follows the plunger back on its return stroke and disintegrates, allowing the pressure from the reaction chambers to release through the opening. The reaction chambers of the units consisted of four split-flow, 18-in. diameter chambers. By split-flow, it is meant that chips entering the top chamber come in at the center and split into two equal streams and proceed to each end by means of a screw conveyor. The chips then drop from each end of this chamber into the ends of the next chamber, where they are conveyed to the center to start the cycle again. Each of these chambers is 18 in. in diameter and 18 ft. long and lined with 304 stainless steel. The cooked chips were then conveyed from the reaction chambers into a size "D" defibrator by means of another small screw at right angles to the reaction chambers. The defibered chips were blown from the defibrator through "poppet" type outlet valves to a pulp storage chest. These units were capable of a production 1¾ to 2 tons per hour of pulp and used 150 psi pressure and "Kraft" liquor at 9.5 per cent Na_2O on A.D. pulp. In 1946 two additional reaction chambers were added to each of these units, and the reaction chambers were speeded up somewhat to increase production and still allow 15½ min. reaction time. Screw feeders replaced the old plungers in 1947. These feeders were initially run at 33 rpm. This feed rate produced approximately two tons per hour. However, trouble with the feed mechanism was not entirely a thing of the past. The feeders were set up to drive from a 50-hp motor, through an American Blower fluid drive, and through a sprocket and chain arrangement to the feed screw. From the first, the feeders pulled a very high load; and interchangeability of parts proved to be impossible, and a combination of runnable parts had to be found by juggling all available parts around until a combination was arrived at that did not overload the motor. During the gradual increase in tonnage on these units, this feeder overload became a very troublesome problem and much work and time were used in trying to solve it. Eventually 60-hp motors were installed, and finally it was necessary to change to a different type of screw feeder in order to keep the horsepower within the motor and fluid drive capacity.

In 1948 the S. C. pulp was changed from kraft liquor to monosulfite with a spectacular improvement in quality. The sheet was much stiffer and had a very much improved crush. Production was gradually raised on the units by speeding up the feeders and reaction chambers, as previously mentioned, and finally by the installation of American Defibrator interrupted flight screws in the reaction chambers. These screws allowed us to run the chambers more nearly full, thus allowing an increase of production for the same reaction time. This move resulted in an increase in production of approximately 15 — 16 per cent to the present level of 3.5 tons per hour. These units are now located in our new consolidated pulp mill and run at a use factor of well over 90 per cent. It was upon erection of the new pulp mill that the second type of continuous pulper was installed at Covington. The so-called M & D unit, which name is derived from its designers, Mr. Messing and Mr. Durkee, was installed in 1950. This unit as installed incorporated a rotary valve type feeder. The valve rotor was 18 in. in diameter, made of 316 stainless steel, and contained two 620-cu. in. pockets, giving a capacity of 0.7 cu. ft. per revolution. The valve was driven from a 20-hp dc motor through a speed reducer and chain. This valve originally had a monel lining, and it was soon found that clearance between rotor and liner was very critical and much time was given to learning the correct clearances to use. The valve was originally fed by a variable speed screw from the bottom of the chip bin. However, it was necessary to dispense with this screw and cut a chute into the side of the bin to feed the valve by gravity. This was due to the erratic filling of the valve pockets resulting in almost constant plugging of the screw. The chips from the rotary valve drop into a rectangular reaction chamber 35 ft. high by 13½ ft. wide center to center. The chamber is 304 stainless steel tube 27¼ in. inside diameter. Around the inner periphery of this tube runs a track 7 in. high and 1¼ in. wide. A chain composed of 68 flat plates linked together, with rollers at the points of linkage, rides on the track to move the chips through the reaction chamber. The chain is pulled by a sprocket located in one of the upper corners of the rectangle, and the rotary valve is located just above this point. Chips feeding in from the rotary valve are transported by the chain down one leg of the rectangle, across the bottom, up the other leg and across the top where they fall out of the chamber into a screw just previous to the point of entry. This 12-in. diameter screw delivers the chips to a size "D" defibrator, from which they pass out through an orifice outlet valve to the blow tank.

Among the mechanical troubles encountered with the reaction chamber chain, corrosion and bending of the plates have been the primary sources. Two chains have now been replaced, and the present one has been constructed of 304 stainless steel and installed in such a manner as to overcome the "jackknifing" and hanging up responsible for bending the plates. The main unsolved problem on the reaction chamber is to avoid excessive wear on the track. One section of the track has required rebuilding three times in the past year.

Varying stock load on the defibrator of this unit caused by the "slugging" action of the chain discharging into the screw feeding the defibrator has been largely overcome. This was accomplished by increasing the effective length of the screw by installing an interrupted flight and matching the speed of the screw exactly to the load being produced by installing a Reeves drive. Reaction time in this unit is now 15 min.

A new 21-in. diameter rotary valve having a capacity of 1.3 cu. ft. per revolution was installed on the M &

(Continued on page 942)

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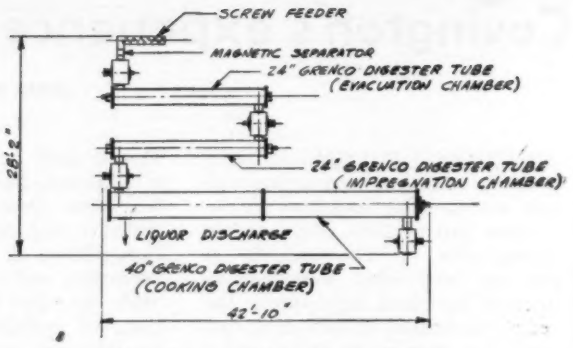
*Paper presented at the Fourth Annual Pulping Conference, University of Florida.

New developments in digesters and digestion techniques

LEE EBERHARDT*



Flow diagram of Bauer-Grenco digester

AT THE PRESENT TIME the field of digester design and digester practice is undergoing a radical change. This change has been brought about by the accelerated interest in automation of process equipment to reduce labor costs, higher yields to reduce raw material costs as well as stream pollution, and simplification of equipment to reduce capital expenditure requirements.

Low-pressure, large-volume digestion equipment as typified by stationary and globe rotary digesters cannot meet the modern demands for efficient, low-cost operation, and low-capital installation cost. Due to design and time cycle considerations capital expenditure per ton of end product on these units is high, the units require a large volume of housing space, and they cannot be utilized for relatively complicated short-cycle high-pressure cooking techniques. If the modern small batch and continuous digestion equipment being designed, built and installed can meet the end product quality requirements of the industry, it is safe to say that conventional digestion equipment is obsolete.

The equipment manufacturers as well as many operating companies and their personnel recognize the trend. All have the usual selfish motive and incentive of profit to their companies. The field apparently is wide open as to ideas, techniques and methods. Good, bad and indifferent designs are being offered, and peddlers from at least seven or eight equipment suppliers can, at the flick of a brief-case lid, present a drawing of the absolute ultimate in digestion equipment.

This, of course, is typical in the early stages of any new development. The attrition of time, and operating experience will undoubtedly eliminate the designs that do not satisfy the rigorous demands of modern operation and end product quality. During the interim period many mistakes will be made, and the going is bound to be rough.

What are the requirements?

The range of digestion temperatures has been widened considerably, and experimental cooks at pressures to 300-lb. steam are being utilized. Presteaming, chip evacuation, pressure impregnation digestion at high pressures, and mechanical breakdown of chips or wood are becoming common practice in laboratory and pilot plant technique.

Impregnation appears to be the key to end product quality when the new short-cycle high-pressure batch or continuous digestion techniques are to be utilized. If nearly perfect impregnation is not obtained, fiber damage occurs and end product quality suffers. This applies not only to high-quality bleachable grades but to board grades as well.

In high-yield digestion procedures impregnation becomes of vital importance. Since cooks of this type are characterized by cooking with a deficiency of cooking chemicals, it is essential that the chemicals available be uniformly distributed through the wood particles being digested.

There are several ways that such impregnation can be accomplished. One approach is to reduce the particle size to present greater surface area to the chemical action or to provide less distance for the chemical to travel to the particle center. W. J. Nolan and his associates have published several articles describing such techniques and the results obtained.

Another approach is the VaPurge methods of subjecting the particles to alternate pressure and pressure relief to obtain air removal followed by pressure impregnation. Many articles on the method have been published by John Hart and his associates at the Canadian Pulp and Paper Institute.

A third approach that appears to have merit is the use of vacuum followed by pressure impregnation. This, of course, is not new experimentally, but it has not been adapted by the industry until now because conventional equipment is not suitable for this type of operation.

At Bauer Bros. we are investigating all of the above types of impregnation procedure, since we feel that proper impregnation is the basic requirement for the new cooking techniques.

We have two types of digestion equipment available to industry: the Rapid Cycle Digester and the Bauer-Grenco Continuous Digester. Both types are available in our laboratories for pilot plant evaluation of client's raw materials.

The rapid cycle digester

The Rapid Cycle Digester has been described and its operation covered in the April, 1955, issue of TAPPI. Reprints of this article can be obtained from Bauer Bros. Co. For those of you who are not familiar with this paper, the unit is a relatively small volume 80- to 300-cu. ft. vertical cylindrical digester of relatively small diameter, 3 to 4½ ft., with large automatic cylinder-operated inlet and discharge valves. The height varies with the unit volume requirement. The materials of construction are usually stainless steel for corrosion resistance, and working pressure on all units to date has been 300 psi.

The unit operation is completely automatic through a control panel, and one operator can handle a number of units without difficulty. Mill tonnage requirements are handled by a multiplicity of units. A number of units are installed in insulation and hardboard mills. The outstanding installation to date being the operation at Pilot Rock, Ore., where two 120-cc. ft. units are producing nearly 175 tons per day of steamed wood for insulation board.

*Bauer Bros. Co. Paper presented at the Fourth Annual Pulping Conference, University of Florida.

The unit is very versatile, and it has the advantage of providing excellent impregnation with all cooking chemicals on all types of wood species. Using high pressures, we have been able to produce fully-cooked chemical pulps in less than 25 min. cover to cover. Cycle time, of course, will vary with yield, chemical, and end product requirements.

Due to batch operation the unit does have the disadvantages of high-surge steam demand and auxiliary equipment requirement for automatic operation. The former has proven not too difficult to overcome, and it has been our experience on the latter that the Rapid Cycle with all auxiliaries is competitive from the standpoint of installed capital cost per daily end product ton.

The Bauer-Grenco digester

The Bauer-Grenco Digester was developed on the West Coast by the Grenco people shortly after World War II. A number of units are installed on the coast in hardboard plants, pulp mills and bark extraction processes.

The unit is somewhat similar to other continuous units in operation, in that, it consists primarly of a conveyor in a pressure tube. Main variations in the design are rotary inlet and discharge valves of proven design and ability of the unit to be elongated by the use of a center bearing feature. Several units 60 ft. in length are in operation. It is, of course, possible to stack the tubes where building or space limitations exist.

The rotary valve consists of a tapered vaned plug rotating continuously at 10 to 25 rpm in a valve body. These valves can be designed for 300-lb. test pressure and are operating successfully at 175-lb. steam pressure. Since eight vanes are utilized on the rotor, the valve can be used to operate at pressure differentials and may be utilized between stacked tubes to isolate one tube from the other, and to obtain differing pressure effects in the digestion operation.

A three-tube stacked unit is being installed in our Springfield laboratory and will be in operation in the near future. In this case we will use four rotary valves—one inlet, one discharge and one between pairs of the three tubes. With this unit it is possible to presteam or use vacuum in the first tube, pressure impregnation in the second and vapor or liquor phase cooking in the third.

Another interesting possibility is a combination of the Rapid Cycle Digester and the Bauer-Grenco Digester. In which case the former would be utilized for impregnation and the latter for continuous digestion in either the liquid or vapor phase cooking. Extensive experimental, pilot plant, and mill scale investigation is under way and contemplated for both units.

A review of some kraft pulping variables*

M. N. MAY**

THE CHEMICAL MECHANISM of delignification in kraft pulping has not been definitely established. However, it is known that sulfur atoms are introduced into the lignin structure, and that this increases the rate of lignin removal without increasing the rate of attack on the carbohydrate fraction. This selective increase in the rate of lignin removal is the principal advantage of the kraft process over the soda process.

Principal variables and their effect on pulp properties

The principal variables in the kraft pulping process may be listed as follows:

(1) The type and condition of wood used
(2) Maximum temperature
(3) Time at maximum temperature
(4) Ratio of cooking chemical to the moisture-free weight of the wood
(5) Concentration of the cooking chemicals
(6) Sulfidity

Type and condition of wood

That the kind of wood affects the type of pulp obtained by the kraft process is well established. This stems from the differences in the physical and chemical properties of the wood species. Even within a single species, there are tree-to-tree variations and within-the-tree variations in physical and chemical properties which affect pulp properties. In general, the hardwoods contain somewhat less lignin and possess somewhat shorter fibers than the softwoods. The hardwoods generally yield pulps of substantially lower strength than kraft pulps. However, since hardwoods tend to have higher wood density and lower lignin content than softwoods, pulp yields are generally somewhat higher for the hardwoods on either a weight per unit weight of moisture-free wood, or a weight per unit volume of wood basis.

The condition of the wood used also has an important bearing on the pulp properties that can be obtained. Decay in wood can seriously reduce pulp yield and, in some instances, will reduce the strength properties of the pulp. Normal variations in the moisture content of the wood, however, have relatively little effect on the cooking operation if an allowance is made for the dilution of the liquor by the water content of the wood and for the variation in the dry weight of wood present in the digester. Chip size does not appear to be as great a factor in alkaline pulping as it is in acid sulfite pulping. The initial penetration of the alkaline liquor into chips seems to take place in the longitudinal direction along the axis of the fibers. However, as the alkali swells the wood, diffusion of the chemicals in the transverse direction seems to occur. The net result is that the alkaline chemicals rather quickly migrate through the chips by penetration and diffusion processes augmented by swelling, and chip size is therefore not extremely critical in the case of normal cooking schedules. Current practice usually calls for an average chip size of ½ to ¾-in. in the fiber direction.

Maximum temperature and time at maximum temperature

Rates of most chemical reactions increase with increasing temperature. Consequently, the maximum temperature used in digestion influences the rates of removal of the various wood constituents. Obviously, time is coupled with rate of removal, and hence with temperature, in fixing the amounts of the wood components remaining after digestion. As the maximum temperature is increased, the

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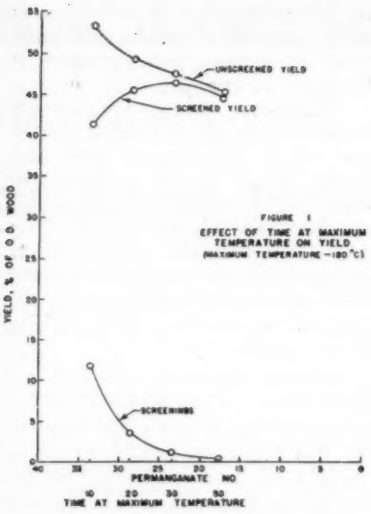

FIGURE 1
EFFECT OF TIME AT MAXIMUM TEMPERATURE ON YIELD
(MAXIMUM TEMPERATURE = 180°C)

time required to obtain a given amount of delignification is reduced.

A series of kraft cooks with southern pine were made at the Institute of Paper Chemistry a few years ago which illustrate some interesting effects of the relationship between maximum temperature and time at maximum temperature. As would be expected, it was found that the time at maximum temperature required to reach a given permanganate number decreased as the maximum temperature increased. As time at maximum temperature was increased at a given maximum temperature, the unscreened yield and the per cent screenings decreased in such a way that a maximum occurred in screened yield. This is illustrated in Fig. 1. The times at maximum temperature corresponding to the maximum screened yields for the various maximum temperatures studied are shown with some associated data of interest in Table I. The maximum temperature in this work was varied from 160 to 180°C. in increments of 4 degrees.

To summarize these results briefly, a maximum screened yield was found for each maximum temperature as time at maximum temperature was varied. This maximum screened yield was found to increase slightly as the maximum temperature was decreased. The most interesting point in this comparison is that the pulps obtained at maximum screened yield under each maximum temperature were very similar in strength properties. Thus, the use of maximum temperatures of up to 180°C. gave substantial reductions in cooking time, apparently without significantly reducing strength. It should be pointed out, however, that these studies were made using a liquor circulation rate higher than that usually used in commercial practice. At very low circulation rates, strength may be somewhat more dependent on maximum temperature.

Chemical ratio and chemical concentration

The chemical-to-wood ratio and the liquor-to-wood ratio fix the initial concentration of the cooking chemicals. Since the rate of any chemical reaction is a function of the concentration of the reactants, the concentration of the cooking chemicals is a very important factor in the rate of delignification.

If one desires to achieve a given degree of delignification in a given time and at a given temperature, but with a varying water ratio, it is not sufficient simply to vary the chemical-to-wood ratio in such a way as to maintain the initial chemical concentration constant; there will be an increase in the amount of original active chemicals unconsumed at the end of the reaction, and the driving force during the course of the reaction will not be the same. Thus, the usual practice of specifying the initial chemical-to-wood ratio (active alkali), initial water-to-wood ratio—and through these two variables, the initial concentration—is not sufficient to define the rate of delignification, since the rate at any instant is a function of the concentration at that instant. The initial concentration does not by itself fix the concentration during the remainder of the cook.

This point is indicated by the data in Table II. In this table, cooks using black spruce chips are summarized in which the water ratio was varied from 3.0 to 6.0 cc./g. of oven-dry wood. The lignin content of these three pulps was very nearly the same. To obtain this degree of delignification, it will be noted that the active alkali had to be increased with increasing water ratio, but in such a way that the initial chemical concentration decreased. These cooks were all made with the same time and temperature schedule. It will also be noted that at a given degree of delignification, changing the water-to-wood ratio and active alkali had no substantial effect on either screened yield or strength properties, although tear was somewhat lower at the lowest water-to-wood ratio.

The water present in the digester acts to convey the cooking chemicals to the lignin. In rotating digesters where good contact of the chips and liquor is promoted by the tumbling action, water-to-wood ratios are generally somewhat lower than they are with stationary digesters. Keeping the water-to-wood ratio as low as possible, and hence also the chemical-to-wood ratio, is quite desirable from the standpoint of minimizing the load on the recovery system.

A factor closely associated with the chemical- and water-to-wood ratio is circulation. Circulation principally affects the uniformity of the pulping operation and should be sufficient to accomplish the degree of uniformity desired. Increasing circulation rates beyond this point is of no particular benefit—at least within any reasonable range. The lack of sensitivity of pulp to relatively high circulation rates is illustrated in Table III. Here again, black spruce was the wood used, and all pulping conditions were held constant with the exception of circulation rate, which was varied from 3.3 l./min. to 16.8 l./min. This work was done in a digester of 40-liter capacity so these circulation rates corresponded to a complete turn-over of the liquor in the digester in 2.5 to 12 min. It will be noted that there was essentially no difference in lignin content, permanganate number, or beaten pulp properties. These rates are higher than those generally employed in commercial digesters, and inadequate circulation can contribute to low yields, high screenings, and poor strength.

Sulfidity

As has been mentioned previously, the addition of sodium sulfide to a sodium hydroxide cooking liquor greatly increases the rate of delignification without a simultaneous increase in the rate of carbohydrate attack. This permits faster pulping to a given level of delignification, with better pulp strength properties at the given level. Kress and McGregor (1) found when using a total chemical-to-wood ratio of 20 lb. as sodium hydroxide per 100 lb. of bone-dry wood that optimum delignification occurred at a ratio of one part sodium sulfide to two parts of sodium hydroxide. They also found an optimum in maximum bursting strength and in tear at maximum burst at this level. Hanson (2) found that the optimum sulfidity with respect to delignification increases linearly with the chemical-to-wood ratio, ranging from an optimum at 33 per cent sulfidity with an active alkali of 15.5 per cent (as Na_2O) to 100 per cent sulfidity at an active alkali of 39 per cent (as Na_2O). The work of Bray and Martin (3) indicated that there is a minimum effective alkali required for pulping, effective alkali being defined as the total sodium hydroxide present in the liquor, assuming complete hydrolysis of the sodium sulfide. To keep effective alkali constant with increasing sulfidity, the active alkali must be increased. Stated in another

way, if active alkali is held constant and sulfidity is increased, the effective alkali is decreased. Bray and Martin found the minimum effective alkali necessary for pulping of sweetgum chips to be about 10 or 11 per cent. This was at a constant active alkali of 12.98 per cent. Tomlinson (4) indicates the opinion that for any given quantity of hydrosulfide, based on wood, and for any given species, there is a minimum effective sodium hydroxide requirement to give any desired degree of pulping. This conclusion was based in part on the work of Buchanan and Koon (5) who indicated that sodium hydrosulfide in itself in the absence of effective sodium hydroxide is not a suitable pulping agent.

Much of the literature on this subject indicates that it is the sodium hydrosulfide resulting from the hydrolysis of sodium sulfide which reacts with the lignin in such a way as to introduce sulfur into the lignin molecule. However, Borlew (6) has recently argued against this conclusion, feeling that under usual conditions in the digester, the sodium sulfide is only partly hydrolyzed to sodium hydrosulfide.

All of this indicates that there is still uncertainty about the effect of sodium sulfide in kraft pulping. However, certain points do seem evident. Under the conditions most frequently used in kraft pulping, increasing sulfidity up to 25-30 per cent appears beneficial from the standpoint of reducing cooking time and improving strength. In most instances, minor changes in sulfidity in the range of 25-30 per cent do not greatly affect pulp properties, although there are probably exceptions to this general rule.

Another variable of somewhat lesser importance is the use of black liquor for obtaining the desired water-to-wood ratio. Mattson (7), in a study of this variable, found that the residual alkali in recycled black liquor has actual value as a cooking agent.

Literature Cited

(1) Kress, Otto, and McGregor, George H. *Paper Trade J.* 96, No. 24:40-42 (June 15, 1933).

(2) Hanson, Fred S., *Paper Trade J.* 112, No. 2:32-38 (Jan. 9, 1941).

(3) Bray, M. W., and Martin, J. S., *Tech. Assoc. Papers* 24:251-263 (1941).

(4) Tomlinson, G. H. II., "Manufacture of Alkaline-Process Pulps." In Stephenson's "Pulp and Paper Manufacture," Vol. I, p. 395 New York, McGraw-Hill, 1950.

(5) Buchanan, M. A., and Koon, C. M. *Paper Trade J.* 115:190 (1942).

(6) Borlew, Peter B. Paper presented during Ninth Alkaline Pulping Conference of the Technical Association of the Pulp and Paper Industry, Chattanooga, Tenn., Oct. 19, 1955.

(7) Mattson, Victor F., Paper presented during the Ninth Alkaline Pulping Conference of the Technical Association of the Pulp and Paper Industry, Chattanooga, Tenn., Oct. 19, 1955.

TABLE I—Time at Maximum Temperature Producing Maximum Screen Pulp Yield

Maximum temperature, °C.	180	176	172	168	164	160
Time at max. temp., min.	30	50	50	68	120	160
Permanganate number	23.4	24.2	30.0	31.1	27.3	28.6
Screened yield, %	46.6	47.0	47.7	48.4	48.4	49.1
Pulp Properties at 450-cc. Schopper-Riegler Freeness						
Beating time, min.	46	48	54	58	51	55
Bursting strength, pt./100 lb.	166	174	166	168	174	168
Tear factor	2.50	2.50	2.35	2.30	2.45	2.85

Constant conditions:	
Wood:	Southern Pine
Moisture content, %	45-47
Chip size, in.	½
Chemical ratio, % as Na_2O	19.0
Sulfidity, %	20.0
Water ratio (oven-dry wood basis), cc./g.	4.5
Time to max. temp., min.	60
Time to relieve to blowing pressure of 80 psi, min.	15

TABLE II—Influence of Chemical Ratio and Water Ratio At Similar Degrees of Delignification

Constant Conditions			
Wood	Black spruce		
Chip size, in.	½		
Sulfidity, %	28.0		
Maximum temperature, °C.	173		
Time to max. temperature, min.	120		
Time at max. temperature, min.	120		
Blowdown time, min.	15		
Variable Conditions			
Water ratio (oven-dry wood basis), cc./g.	3.0	4.5	6.0
Active alkali (as Na_2O), %	14.7	15.9	17.4
Initial chemical concentration, g. Na_2O/l	49.0	35.3	29.0
Pulp Properties			
Screened yield, %	48.9	47.6	48.4
Permanganate number	20.4	21.8	21.2
Lignin, %	3.9	3.8	3.8
Properties at 30 min. beating:			
Bursting strength, pt./100 lb.	225	205	215
Tear factor	1.38	1.62	1.58
Schopper tensile, lb./in.	47.0	47.5	49.9

TABLE III—Effect of Circulation

Constant Conditions			
Wood	Black spruce		
Chip size, in.	½		
Sulfidity, %	28.0		
Water ratio (oven-dry wood basis), cc./g.	4.5		
Active alkali (as Na_2O), %	15.7		
Maximum temperature, °C.	173		
Time to max. temp., min.	120		
Time at max. temp., min.	120		
Blowdown time, min.	15		
Variable Conditions			
Circulation rate, l./min.	3.3	6.75	16.8
Pulp Properties			
Screened yield, %	48.3	47.4	48.2
Permanganate number	22.2	20.5	21.0
Lignin, %	4.1	3.5	3.5
Properties at 30 min. beating:			
Bursting strength, pt./100 lb.	189	184	192
Tear factor	1.66	1.48	1.64
Schopper tensile, lb./in.	49.1	41.5	48.1

Kraft cooking for easy bleaching and board pulps

FRED W. BISHOP*

THE FINISHED PRODUCTS at Southland Paper Mills employing kraft pulp in the furnish are standard newsprint and folding grades of cylinder board. With open couch draws on the existing newsprint machines, the most desirable physical property of the semi-bleached kraft to this furnish is high tear. As bleached kraft is used as the liner of paperboard products and unbleached and semi-bleached as the filler furnish, the pulps must not be radically different in physical characteristics between bleached and unbleached for compatibility in regards to the ply bonding of these different materials on a five-vat machine. As high tear is coincidental with other good pulp properties, the evolution of a pulping procedure to produce optimum pulp qualities for the paperboard operation will be discussed later.

Description of equipment and processes

The digesters of 2750-cu. ft. capacity employ direct steaming and forced circulation from the bottom to the top with the normal charge of chips weighing 64,000 lb. At the beginning of a cycle a small quantity of chips is added to the bottom of the digester, and then the liquor is started with the chips continuing to be added in such a manner that chips and liquor are added together until the digester is full. When the cap is on, the steaming is started and the circulating pump started at the same time. The time to full pressure of 100 psi at a temperature of 340° F. is, generally, 80 minutes with approximately 90 per cent of gas-off occurring during the time to pressure. The cook is held at full pressure for 40 to 45 min. before blowing to produce a total time of, roughly 2 hrs. and a pulp of 20 permanganate number. The cooking cycle is all controlled manually by the digester cooks with no automatic control equipment being employed to regulate the cycle.

After washing and conventional centrifugal screening, the unbleached pulp moves to the bleach plant. The bleaching process employs direct chlorination, caustic extraction, and high-density hypochlorite for the production of semibleached pulp for newsprint requirements. Some of the semi-bleached moves through a fourth stage low-density hypochlorite for final bleaching to produce the liner furnish for paperboard products.

Evolution of optimum pulping

The Noble & Wood beater with the 300-lb. roll and requiring a 5-lb. pulp sample has been used to evaluate pulp quality during the operation of this mill. To those who are concerned with pulp quality, this beater has been large enough, and capable of sufficient horse power input for the refining of pulp, that its results might more directly correlate with a heavier type of refining tackle used in mill operation. This beater had been a very effective tool in highlighting poor qualities of a pulp which for years was purchased for the newsprint furnish. In the early days of Southland's own kraft operation, the results from this equipment began to show that the pulp was considerably stronger than purchased pulp.

At this point, it was decided that beater runs should be made on pulps of known high strength from United States, Canadian, and Scandinavian mills. These high-strength pulps were characterized by what is known as a flat freeness curve. This is interpreted to mean that after extensive and prolonged high horse power input, the freeness fails to drop considerably, and the refined pulp continues to have body and not the slick-mushy feeling of highly refined soft pulps. On a pulp with the flat freeness curve, the mullen development is normally slow but, after considerable horse power input, will reach a peak as high as that from any soft pulp. With a flat freeness curve pulp, the tear would generally start at a high level and fail to drop off very rapidly with additional horse power input. In speaking of "hard" or "soft" stock, the reference is made to resistance to beating and not to permanganate number. It was concluded that a pulp characterized by the flat freeness curve was one which could absorb high horse power input from the refining tackle in a mill for improved sheet formation properties without radically altering the drainage rate of the raw pulp. It is one in which a controlled mullen development could be produced, thereby bypassing the "hair-triggered" soft pulp mullen development. It was further concluded that the capital and operating cost of sufficient installed refining equipment was a good investment when properly used with a strong workable pulp for the development of good machine operating and finished product qualities.

Pulping variables studied

It is normally concluded that the bulk of the strength of Scandinavian pulps is derived from the wood qualities, and some authorities attribute a portion of the strength to long slow pulping technique. In the South, comparable quality wood is not available, and mill production schedules are such that a study of the long cook was not practicable. Logically, pulping procedures producing strong pulps in the southern region would be of greatest interest in attempting to duplicate their practices in the Southland mill. In the work that was done to change the pulp characteristics, certain variables were picked out for change, while other factors were held as nearly constant as possible. The initial study considered cooking time, amount of active alkali in the digester, amount of total liquid volume, pressure, temperature, etc. These same items were studied in other mill operations of the South to arrive at certain changes to be attempted in this mill. Accord-

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ingly, the following table is presented showing the operation at Southland and other mills, and the data include what is considered to be the pertinent variables which will direct the thinking toward the proper conditions for producing high strength pulps.

	Mill A (Indirect Cooks)	Mill B	Southland Former	(Direct Cook) Present
Active Alkali, lbs.	6700	7060	5000	5300
Yield, tons	8.8	11.3	8.0	8.3
A.A. per ton	760	625	625	640
White Liq., cu. ft.	1080	1250	700	770
Black Liq., cu. ft.	520	0	340	180
Total Vol., cu. ft.	1600	1250	1040	950
Steam, cu. ft.	0	0	500	500
Total Dilution, cu. ft.	1600	1250	1540	1450
Lbs. A.A. per cu. ft.				
At Start	4.18	5.65	4.81	5.58
At end	4.18	5.65	3.25	3.65
Total Time, hrs.	3	—	3	2

The liquid volume from moisture in the chips is considered to be the same in all mills and will not radically change the chemical concentration relationship. In Mill B operation, 550 cu. ft. of black liquor is pumped into the digester just before it is blown. The pounds of active alkali per cubic foot of liquid volume at the end of the cook in the table does not represent chemical concentration at that time but shows only the effect of steam dilution.

Mill B in the tabulation above produces a pulp with the flatest freeness curve of any pulp tested from southern production. After looking over its data in the table, the one obvious point of difference was the high concentration of active alkali per cubic foot of liquor volume at the beginning of the cook, plus the fact that the volume was not diluted during the cook because it was steamed indirectly. Although both Mills A and B use indirect cooking methods, the main difference in their operation is the pounds of active alkali in the liquor volume at the start of the cook. The pulp from Mill A has a freeness curve that drops off very fast, and this aspect is accompanied by fast-developing but low-peak mullen and poor tear. As the Southland liquor concentration formerly fell between that of Mill A and Mill B, and as the pulp strength also fell between these, it was decided that possibly this liquor concentration, particularly during the early stages of the cook, might be the governing factor in the production of the required high-strength pulp.

In order to arrive at a liquor concentration comparable to that of Mill B, it was necessary to increase the active alkali to 5300 lb. and to reduce the total volume to 950 cu. ft. Considering former experience, the operators were very much concerned that "the chips would be burned, the digesters would not circulate, the cook would be half rejects," etc. Happily, none of these things materialized, but the development problem was quite interesting, particularly in convincing the operators that a lot of things they had been told for so long were not necessarily true. Under these conditions of high initial active alkali concentration, it was necessary to shorten the cooking time, and it is the feeling that this shortened time was also an added advantage to the production of high-strength pulp. With the total cooking time reduced to 2 hours, pulp was produced for a number of years, and, during this time, it was considered to be one of the strongest pulps in the South.

To sum up Southland's opinion of how to produce strong pulp, it is necessary to get the chips into the digester in the presence of high initial chemical concentration, get the cook up to pressure as fast as conveniently possible, and finally, to blow it as soon as the pulping is complete. It is felt that the high chemical concentration is the contributing factor which allows such short cooking time and still allows the chips to be cooked to a moderately soft pulp. It appears that fiber degradation is a function of prolonged retention time in the digester after the bulk of delignification has occurred.

Sulfidity level

Of passing interest on the above subject of manufacturing strong pulp will be some experience regarding the required sulfidity level under these conditions. The above pulps had been produced for approximately a year with the sulfidity in the white liquor at approximately 25 per cent based on the total alkali, and this was maintained by adding sulfur to the digesters. The sulfur was removed from the digesters, and the sulfidity dropped to 18 per cent without any deterimental effects on pulp quality. It is the feeling in this mill that pulps produced by the high concentration, short-time cook can maintain their strength characteristics with extremely low sulfidities in the order of 12 — 15 per cent. It appears that the bulk of the pulping action is carried out by the caustic portion of the active alkali so rapidly that high-sulfidity requirements for fast cooks are not indicated.

Spring- and summer-wood pulps

Of further interest to the operation at Southland is the fact that the wood is sorted from the barking drum to send the smooth and relatively knot-free wood to the grinding operation. Of necessity, the grinders use the trunk wood of the tree, with the kraft pulp mill utilizing the residue of tops and crooked wood. Accordingly, a very low-density wood which is extremely high in spring-wood content is used in kraft pulping at very low yields per cord. With this type of wood being employed in the digesters, it was decided that a study should be made to determine the fundamental difference between pulps produced from separated spring-wood and summer-wood. For this experiment, a fresh log of average growth rate, fairly free of knots, and approximately 11 in. in diameter was selected. The stick was cut into ¾ in. thick discs as needed, peeled to remove the bark, and the spring and summer growth separated by hand using chisels and mallets. The two chip samples were pulped separately in stainless steel baskets suspended in the digester of a normal cook.

Hand sheets of the screened pulp showed the fibers of the summer-wood to be coarse and raggy with poor formation qualities. The sheet from the spring wood had very good formation qualities and considerable snap and rattle. In the laboratory beater the summer wood had a fast dropping freeness and a rather ordinary mullen curve with an extremely high tear. In the beater, the spring-wood had a rather flat freeness curve with an extremely high mullen development and a low tear.

In fairness to all the claims for producing strong pulp, it should be pointed out that some departures have been made in the past few years of operation. At best the short cook is difficult to control with an occasional raw cook being produced, and, of course, re-blowing is a frequent necessity with an occasionally plugged blow line. Most of these difficulties can be eliminated by pumping in black liquor just before the blow. With increased production and overloading of the washers and evaporators, the operators were happy to see the advent of slightly higher volume and a little longer cooking time.

High yield kraft pulping

J. McK. LIMERICK*

AS PULP MANUFACTURING costs, including raw material and labor, continue to rise, the pulp and paper industry has exerted every effort to produce a satisfactory product at the minimum possible price to the consumer. One method of counteracting the rise in costs is to obtain increased yields from the basic raw material—wood. A glance at Table I will give a good illustration of the possibilities. It is based on wood having a density of 0.35 and priced for convenience at $25.00 per cunit. The savings are shown in dollars per ton of pulp by increasing the yield to various percentages over 50 per cent, which is taken as the standard.

Table I—Savings in Wood Costs per Ton of Pulp by Increased Yields. Wood at $25.00 per Cunit—Density 0.35.

Per Cent Yield O.D. Wood — O.D. Pulp	Savings per Ton of Pulp Dollars
50	0.00
55	4.10
60	7.70
65	10.50
70	13.10

There are other advantages in obtaining higher yield from the wood. A greater production can be obtained from a given number of digesters, and there is a distinct conservation of natural resources. For example, at Bathurst Power & Paper Co., Ltd., where the first commercially successful high-yield pulping operation was carried out, three cords of wood are producing the same amount of pulp as four under the former conventional system.

General layout of the high-yield process

A typical flow diagram (the Bathurst layout) is shown in Fig. 1. Pulp from the digester is blown to a conventional blow tank. From this tank it passes through a magnetic separator to remove tramp metal and then to a breaker trap or some type of pre-breaker, which acts as a chip breaker and also as a further protection to the refiners in catching any tramp metal not removed at the magnetic separator. The pulp then passes to the brown stock refiners. They refine the pulp in the presence of hot black liquor and defiber the coarse fractions, thus making it possible to utilize pulps cooked to a lesser degree and having a higher yield. From the brown stock refiners the pulp goes to the refiner chest, from which it is pumped to the washing system, screens, thickeners and hence to the paper machine.

It should be mentioned that all the pulp coming from the digesters is accepted stock in the process as operated at Bathurst. After the brown stock refiners there are no knotter rejects, and the rejects from the screens are given a treatment in one jordan and then returned to the accepted stock system to be used in the regular kraft products, which are liner and corrugating board.

A variation of the above system has been put into operation at Southern Paperboard Corp. and, more recently, at Container Corporation of America's mill at Fernandina, Fla. In this process the pulp from the blow tank passes through a pre-breaker, then to the washers, and refining is carried out after washing. Certain advantages are claimed for this method, such as improved washing and reduction of foaming trouble associated with washing, which is a distinct problem with southern woods.

Cooking high-yield kraft pulp

Research work and nearly 10 years of experience at Bathurst have shown that the successful production of high-yield kraft is not simply a question of installing brown stock refining. Proper cooking is of prime importance. Lack of uniform cooking, which produces under- and over-cooked chips to be sent to the refiners, will make high-yield pulping an unsuccessful operation. Uncooked portions of chips will not be properly handled by the refiners and will, in fact, plug the grooves of some types so that the refiner capacity is reduced. Uncooked portions of chips make washing losses high and give trouble and high rejects in screening.

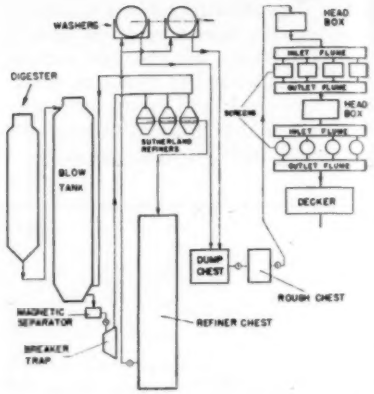


Fig. 1—Flow diagram of Bathurst layout

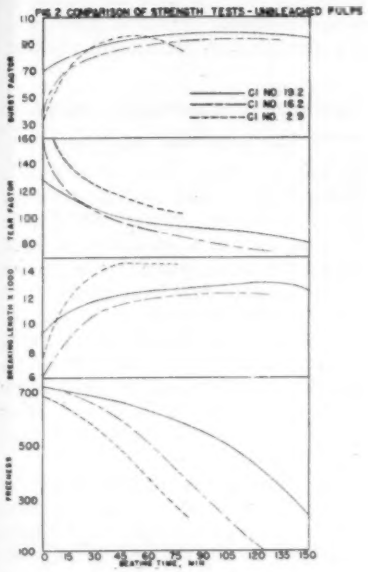
The important feature in high-yield pulping is, of course, to cook to a lesser degree and higher lignin content, but this lesser cooking degree should be uniform throughout the entire chip. Uniform and complete penetration of the cooking liquor is the first essential. Any means of accomplishing this as quickly as possible is of great value. Some means of chip pretreatment, such as Va-Purge or a modification of it, has been found to be of considerable assistance. Once complete penetration has been accomplished, temperature and pressure can be raised very quickly without harmful effects upon the resulting pulp. Experiments at Bathurst have also indicated that higher maximum temperatures and pressures than normally used can be employed with a saving in cooking time, but once again it must be stressed that such conditions must be preceded by a complete and uniform penetration of the cooking liquor into the chips. The experience of the author is that smaller chip size is of advantage.

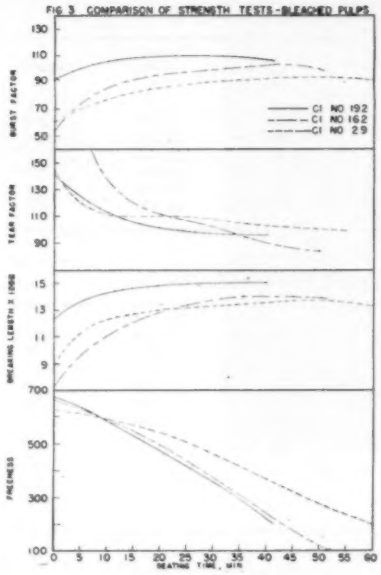
It will be clear that higher yields will mean a lower active alkali charge per ton of pulp, even though the total alkali charge to the digester is not changed from the former low-yield practice. At present, the Bathurst figure is 435 lb. of active alkali per ton of pulp.

It might be of interest to note that in the Bathurst mill, as a result of several years of research and development work, the pulp in the present 62 - 65 per cent yield range actually has the physical appearance of a softer cook than that of the former 50 - 55 per cent yield type. The appearance results from the uniform cook and

*Research director, Bathurst Power & Paper Co. Ltd.

Paper presented at the Fourth Annual Pulping Conference, University of Florida.





consequent defibering into uniform fiber bundles.

Brown stock refining of high yield pulp

Kraft pulp in contact with hot black liquor refines very easily with a relatively low power requirement. However, the amount and type of refining given at this stage will depend upon the requirements of the individual mill and its equipment. The objectives can range from a pulp having a minimum of freeness drop and strength development, which is simply well defibered and will wash and screen readily, to one which has been given a considerable strength development. The type of washers and the washing capacity of the mill will have a great bearing on the degree of refining. A pulp which has had too much refining and thus a low drainage, will reduce the capacity of rotary washers or raise the alkali loss in washing.

Whatever the balance established between the degree of refining and washing, it is essential that the variables be under control and kept at a constant value. Cooking degree, blow tank consistency, disc loading, and refiner inlet pressure must be maintained constantly at the proper values determined for the particular mill. Wherever these values can be maintained by automatic controls, these should be installed. Once again it becomes a question of uniform operation in the refining department for satisfactory operation. A typical set of figures for the Bathurst operation would be: consistency 3.7 per cent, disc loading 55 amps, refiner pressure 15 lb., and freeness drop from 750 to 700 Canadian standard. Power requirements for brown stock refining (including breaker trap) are 3.7 hp days per ton.

Washing high yield pulp

As mentioned in the previous section, washing and brown stock refining are closely related and dependent upon each other. The statement only applies if washing follows brown stock refining. If the system used at Southern Paperboard is in operation, the degree of washing is not governed by the refining operation. Should pressure washing be in operation following brown stock refining, presumably a different type of pulp might be needed from the refiners. When the desired characteristics have been established, the operation should be rigidly controlled within narrow limits and within complete instrumentation and testing. Variations in drainage, which will occur if the operation (especially refining) is not under complete control, will result in completely unsatisfactory washing and eliminate some of the advantage of high yield pulping.

Properties of high-yield pulp

Perhaps the best method of showing the characteristics of high-yield pulps is to examine a number of tables and curves which set forth the various properties. Two commercial Bathurst high-yield pulps having chlorine numbers of 16.2 and 19.2 are used as representative pulps. The pulp of 16.2 chlorine number was produced from 70 per cent white spruce and 30 per cent balsam fir. The pulp having the chlorine number of 19.2 was cooked from 82 per cent balsam, 16 per cent white spruce and 2 per cent black spruce. For comparative purposes, a commercial bleachable grade kraft pulp having a chlorine number of 2.9 was obtained from a mill in the same area and analyzed for the same properties.

Some general yields and analytical results are shown in Table II. The yields are expressed as per cent of oven dry wood.

Table II—Yields Calculated on Dry Wood

	Cl. No. 2.9	Cl. No. 16.2	Cl. No. 19.2
Unscreened Yield, %	—	62	64
Lignin, %	1.27	9.3	11.4
Flat Screen Rejects (on .007 Lab Flat Screen), %	—	1.7	3.1
Screened Yield, %	47	60.3	60.9

In Table III are shown the chemical analyses of the screened, unbleached pulps.

Table III—Chemical Analyses of Screened Unbleached Pulps

	Cl. No. 2.9	Cl. No. 16.2	Cl. No. 19.2
Lignin, %	2.7	13.2	16.6
Holocellulose, %	96.7	85.4	83.0
Alpha Cellulose, %	87.0	72.7	70.7
Hemicellulose, %	9.7	12.7	12.3
Pentosan, %	8.0	9.6	9.1

Beater tests on the pulps carried out in the Valley beater according to TAPPI Standard T200 are shown in Tables IV, V and VI. The same information in graph form is given in Fig. 2.

A comparison of the essential strength tests is shown in Table VII.

The high-yield pulps are, of course, much higher in lignin content. Such pulps are more difficult to beat, as shown on the curves. When refined in the presence of hot black liquor, this hard beating characteristic is not so pronounced especially in the early stages of beating, and the mullen strength can be relatively easily raised in the brown stock refiners. However, a drastic refining in the brown stock stage, as mentioned above, will usually create such operating difficulties in washing that the treatment has to be modified. The so-called unbeaten strength in the beater tests is that of the pulp after brown stock refining, and it is frequently quite high for that reason. It should also be noted that the hemicellulose content of high-yield pulps is greater than normal. This may have some interesting pos-

Table IV—Beater Test—Unbleached Kraft—Cl. No. 2.9

Beating Time, Min.	Freeness, ml.	Density	Burst Factor	Tear Factor	Breaking length, in.	Stretch, %
0	681	0.650	32.1	250	7,100	3.4
15	630	0.710	74.0	138	12,100	3.3
30	566	0.724	87.8	126	13,700	3.3
45	479	0.750	94.8	115	14,600	3.5
60	370	0.768	93.3	108	14,500	3.6
75	266	0.781	87.2	103	14,500	3.7

Table V—Beater Test—Unbleached Kraft—Cl. No. 16.2

Beating Time, Min.	Freeness, ml.	Density	Burst Factor	Tear Factor	Breaking length, in.	Stretch, %
0	718	0.441	36.1	155	6,120	2.7
10	701	0.510	68.3	125	8,190	2.9
40	606	0.606	84.5	99	11,400	3.4
60	507	0.642	88.5	92	11,880	3.6
80	376	0.666	91.2	84	12,150	3.6
95	283	0.685	92.5	82	12,260	3.7
110	184	0.690	93.4	77	12,290	3.6
125	103	0.699	93.2	74	12,230	3.5

Table VI—Beater Test—Unbleached Kraft—Cl. No. 19.2

Beating Time, Min.	Freeness, ml.	Density	Burst Factor	Test Factor	Breaking length, in.	Stretch, %
0	717	0.575	69.6	128	9,460	3.6
30	679	0.651	88	107	11,800	3.9
60	624	0.672	94	96	12,500	4.1
90	549	0.718	98	92	12,850	4.2
120	425	0.751	98	88	13,100	4.2
150	235	0.764	93	80	12,400	4.2
180	98	0.789	90	77	12,200	4.2

Table VII—Comparison of Unbleached Pulps.

	At O Beating Time			At 450 Freeness		
	Cl. No. 2.9	Cl. No. 16.2	Cl. No. 19.2	Cl. No. 2.9	Cl. No. 16.2	Cl. No. 19.2
Freeness (Canadian), ml.	681	718	717	450	450	450
Time to Freeness, min.	0	0	0	49	69	116
Burst Factor	32.1	36.1	69.6	94.4	90	98
Tear Factor	250	155	128	113	88.5	89
Density, g./cc.	0.650	0.441	0.575	0.755	0.652	0.747
Breaking Length, in.	7100	6120	9460	14,600	12,000	13,100
Stretch, %	3.4	2.7	3.6	3.5	3.6	4.2

sibilities, and work is underway to study means of cooking that will tend to selectively remove lignin and leave the hemicellulose content as high as possible. When all pulps have been beaten to the same freeness, the mullen strengths of the high-yield types compare very favorably with conventional pulps and are frequently higher, possibly due to the higher hemicellulose. If will be noted that high-yield pulps are most frequently used in the production of linerboard, and mullen is the principal strength requirement.

The bursting strengths of high-yield pulps very frequently reach their maximum between 500 and 600 freeness, and from this point the curve flattens out and further beating does not make any change in mullen.

Experiments on bleaching high yield kraft

Samples of all three pulps mentioned above were bleached experimentally in the laboratory. The bleaching steps were as follows: chlorination, caustic extraction, chlorination, caustic extraction, hypochlorite bleach, wash, hypochlorite bleach. All pulps were bleached to a G.E. brightness of 82. The pulps of 16.2 and 19.2 chlorine numbers required respectively 17 and 20 per cent of chlorine, which of course is very high, but they also gave bleached yields from the dry wood of 51 and 50 per cent respectively. The comparison of strength test curves is shown in Fig. 3.

It will be noted that, once the lignin has been removed by bleaching, the high-yield pulps become faster beating than the regular bleached grade, and the strength tests are usually superior.

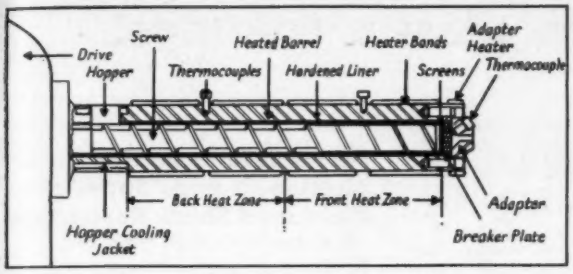
Covington's Continuous Pulpers

(Continued from page 933)

D unit in 1954. This valve uses a Stellited rotor and a Ni-hard liner giving a life of approximately 3000 hr. compared to a maximum of 1800 hr. on the 18-in. valve. By using this valve, tonnage has been raised from 4 to 5 tons per hour at 14 rpm of the 21-in. valve. This feeder is doing a fine job and gives good dependable results as compared to our screw feeders, although it is hoped other untried metals will help us extend the life of the valves.

The newest continuous pulper at Covington was put into operation this past October. This unit was built by American Defibrator and is a combination of the two older types. The rotary valve is exactly the same as the valve in use on the M & D unit. The reaction chamber consists of two 40-in. diameter tubes in series, each tube 30 ft. long and feeding from end to end. These chambers have interrupted flight screws, and both screws and chambers are of 304 stainless steel. At 2.5 rpm of the reaction chambers, this unit has a reaction time of 21 min. The chips from the reaction chambers are conveyed to the defibrator by a 12-in. screw similar to, but longer than, the one on the M & D unit. From the defibrator, the chips exit through an orifice valve and blow into a common blowtank with the stock from the other units. The unit is producing 4 tons per hour at 21 min. reaction time.

As previously stated, all of the continuous pulp produced at Covington is used for 0.009-in. corrugating board. The pulp from the blowtank is reduced to 750 cc Canadian freeness by passing it through two 48-in. Sutherland refiners and a 36-2 Sprout Waldron all in parallel. The refined pulp is then washed over a two-stage IPCO washing system, using 11½—by 16-ft. drums and approximately 125 gpm of water. Yield from the pulping units is calculated to be 75 per cent O.D. pulp on O.D. wood. The wood is all local hardwoods, predominately oak with 15 - 20 per cent maple, hickory, and poplar, and some other mixed hardwoods. Refining of the pulp requires approximately 16-hp days per ton of paper in the paper mill and approximately 2-hp days per ton in the pulp mill. Chemicals used amount to 6.75 per cent Na_2O on the A.D. weight of pulp produced.



Components of the polyethylene extruder

General view of polyethylene extrusion coating

Polyethylene extrusion coating* — equipment design and operation

ERNEST C. BERNHARDT

THE EXTRUSION COATING process developed by the Polychemicals Dept. of E. I. du Pont de Nemours & Co. for use with polyethylene resin consists essentially of three steps:

(1) Thin film of polyethylene melt is prepared at the sheeting die of an extruder.

(2) The film is drawn down to its final gauge after it leaves the die, and this film of viscose melt is brought in contact with the material to be coated.

(3) The bond between the base material and the resin is set as the lamination is pressed and cooled between the pressure roll and the chill roll.

The extruder consists essentially of an electrically-heated barrel, a metering type screw with rapid compression, screens and breaker plate, and the die.

Long barrels are desirable since longer barrels provide greater heat transfer area and facilitate temperature control of the melt. Furthermore, ultimate capacity of an extruder is dependent in part upon barrel length. The length-to-diameter ratio of the barrel should therefore preferably be 16:1 or greater.

Since the temperature required for polyethylene extrusion lamination is greater than 500° F., which is too high for standard oil heat, electrical heating elements on the extruder barrel and die are recommended. The barrel is heated in two or four independently controlled zones, the temperature in each of the zones being regulated by its separate thermocouple and control instrument.

The hopper section of the barrel is cooled by a water jacket, so that the resin does not stick to the throat of the hopper.

The screw, which conveys the resin through the extruder barrel, is designed so that it can take the polyethylene resin in its unmelted cube-cut form and deliver it as a completely plasticated and homogeneous melt.

The feed section, the first section from the hopper, has the deepest channel along the screw.

The compression section is merely a transition from the feed section to the metering section. The compression usually takes place over one-half turn as an involute compression.

The metering section is always the shallowest section of the screw. It will, therefore, tend to govern the flow of material and will largely determine the output rate of the machine. The metering section is also designed to generate sufficient pressure to force the plastic melt through the die.

The "V"-shape of the die makes it possible to bring the die lips very close to the nip of the rolls, so that there is a minimum of cooling before lamination takes place. To have the most uniform distribution of flow across the width of the slotted die, the size of the inside manifold is as large as possible and the restriction across the die lips is a maximum. A 1½-in. manifold and a jaw opening of approximately 0.018 inches conform to these requirements.

The molten film of polyethylene resin, on leaving the die, is drawn into the nip of two rolls: a rubber pressure roll and a metal chill roll. Lamination of the polyethylene to the paper takes place in the nip of these rolls.

One of the precautions during start-up and shut-down is to keep air from entering the extruder barrel or the die. To keep air from entering the extruder barrel is relatively simple. All that is necessary is never to let the extruder hopper run entirely empty and to shut the machine down when there still is some resin in the hopper.

To keep air from entering the die manifold during a shut-down, the extruder should never be entirely stopped until the barrel temperature, the die temperature, and stock temperature all have lowered to approximately 350° to 400° F.

More than 14,000,000 lb. of polyethylene were consumed for paper coating in the United States during 1954, and preliminary estimates show that the polyethylene consumption for this purpose in 1955 reached to between 25,000,000 and 30,000,000 lb.

*Condensed from a paper presented at the 10th Plastics-Paper Conference of the Technical Association of the Pulp and Paper Industry.

New results and ideas in plastic coatings*

THE COMBINATION OF plastics and paper is constantly leading to new applications for both paper and plastics products and provides the most economic material to meet packaging requirements. This becomes increasingly more apparent as our knowledge and understanding of the performance of a package and its construction widens.

Plastic Coatings and Films

(J. F. Helms, Marathon Corp.)

▶ Polyvinylidine chloride film, the most greaseproof plastic available today, also provides low gas and water vapor transfer. It can be applied to paper by the extrusion or water dispersion techniques, while a copolymer with acrylonitrile is viewed with increasing interest in the solvent coating field. The main disadvantage of polyvinylidine chloride is that it decomposes at a temperature which is within a few degrees of the softening temperature. An improved film dimensional stability upon exposure to heat and absence of discoloration are other properties that would make this film even more popular.

▶ Polyamides and zein, the protein type resins, are generally modified with waxes, plasticizers and resin to obtain good coating viscosities, improved water vapor transfer resistance and flexibility. The addition of wax is especially important in improving the water vapor barrier and reducing surface tack. The main disadvantage of protein-polyamide resins lie in the dark color associated with these resins and their low resistance to heat decomposition.

▶ In view of its slight soluibility in fats, oils, and greases, polyethylene is used in conjunction with aluminum foil or cellophane for maximum grease protection. Its main disadvantages are the difficulty of anchoring ink or bonding other materials to its surface and the development of odor in extruded films (since the extrusion practice involves partial oxidation of polyethylene to improve adhesion to the base sheet), and the excessive surface friction of polyethylene.

Among improved modifications of polyethylene are a sulfochlorinated polyethylene which has elastomeric properties and polyethylenes obtained by low-pressure polymerization that have a higher degree of crystallinity and some of which show improved grease resistance and water vapor permeability, and greatly reduced viscosities of the melts.

▶ The cheapest and most widely used materials to provide water and water vapor barriers are the petroleum waxes. The use of waxes in packaging has increased three-fold since 1940, showing a current annual requirement of 750,000,000 lb. of wax.

The advantage of using wax lies in the low cost and the relatively simple application as a melt at speeds of over 1000 fpm. They offer good water and water vapor protection, fair heat seals, gloss, and fair low-temperature flexibility when properly compounded. However, the occurrence of coating scuff detracts from the appearance of the wrapper, and some deficiencies in coating properties have led to the use of natural and synthetic resins to improve wax compositions, while the inclusion of elastomers improves heat seal strength.

▶ Low molecular weight polyethylenes have found the greatest utilization as a wax additive because they keep coating viscosities at a minimum and hot melt cloud points low enough so that relatively lower coating temperatures may be used. They further improve coating gloss, heat seal strength and resistance to scuff and blocking. One disadvantage of using polyethylene in wax is the increased surface friction and the consequent drag on the packaging machines.

Wax modifications of such resins as nitrocellulose, a special styrene butadiene resin, cyclized rubber and vinyl-chloride-acetate copolymers are used in solvent coatings. They provide good anchorage to the base sheet, their water vapor permeability is low, and the heat seal has immediate grab to effect strong bonds.

▶ Ethylcellulose can be compounded with resins, waxes, and plasticizers to provide hot melt coatings with hard, high-gloss surfaces. However, paraffin-polyethylene compositions are cheaper.

Solvent coatings that provide high-gloss finishes include cellulose nitrate, alkyd resins, chlorinated rubber, vinyl resins, cellulose acetate, and ethylcellulose.

Among the new thermosetting resins made available as gloss coatings for paper are the amine cured epoxy resins. These provide surfaces ranging from rubbery, soft to hard, brittle film.

Polyethylene Coated Multi-wall Bags Show Increased Shock Resistance

(K. A. Arnold, St. Regis Paper Co.)

▶ Multiwall bags containing a polyethylene-coated ply showed shock resistances considerably greater than indicated by any of the standard paper tests. Based on the concept that the paper's performance is more closely correlated to the energy required to break the paper than to the force required to break the paper, the Frag tester was applied to measure shock resistance. The Frag tester has two advantages over other devices. The normal speed at impact is 5.5 ft. per sec., and the test is one of repeated impact until failure occurs. These two advantages seem to simulate the bag-drop test to a much greater degree than do other test instruments in use.

Organic Derivatives of Titanium

(H. C. Brill, E. I. duPont de Nemours & Co., Inc.)

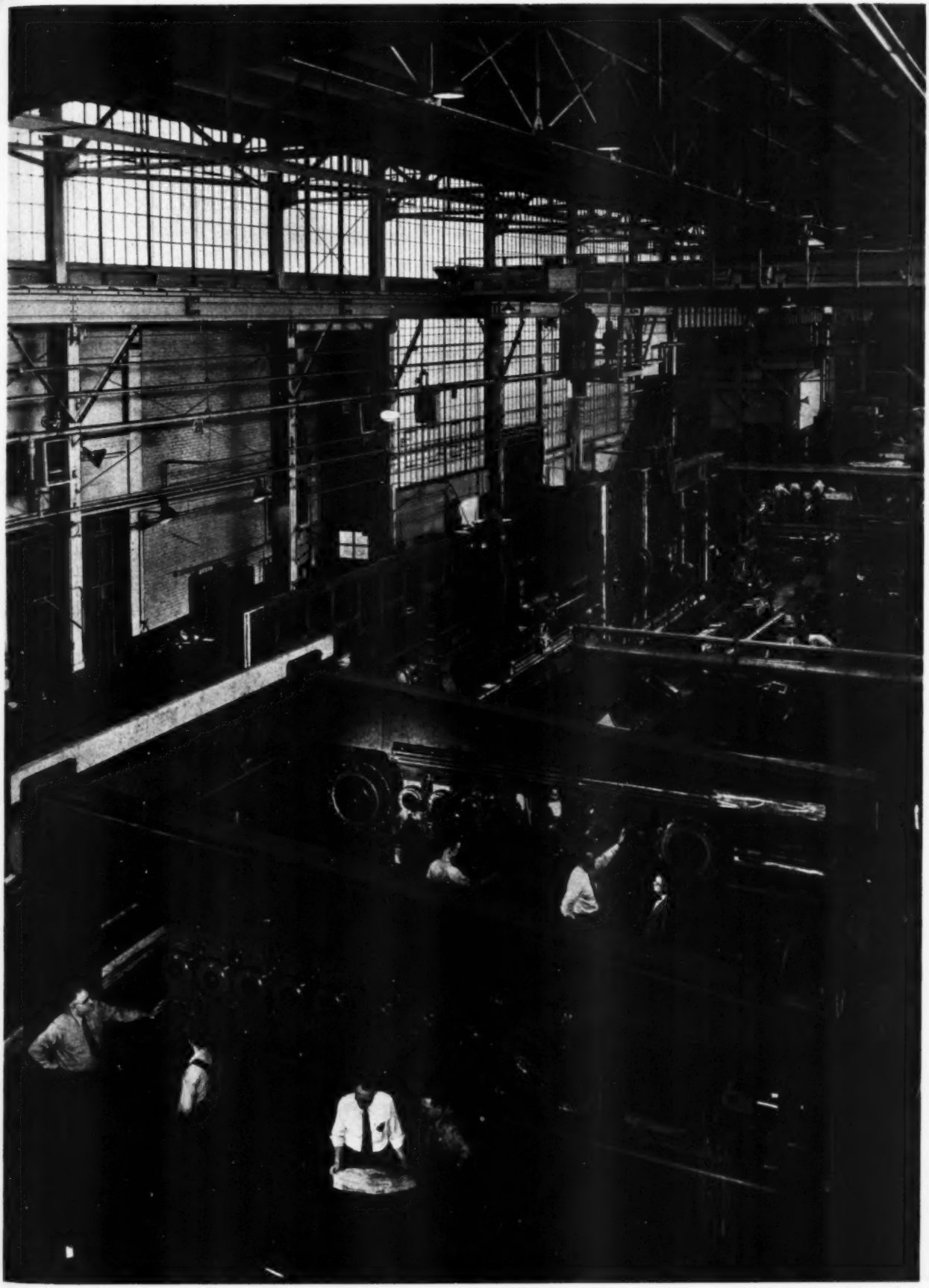
▶ Organic derivatives of titanium can be used to modify lacquers, starches, casein, soya protein, carboxymethylcellulose and polyvinyl alcohol through cross-linking with an organic derivatives of titanium. This cross-linking changes the characteristics of the coating to that of greater insolubility, higher viscosity, higher melting point and faster set-up time. Certain titanium chelates may be used in a trigger mechanism that permits application of film, and cross-linking occurs *"in situ"*.

▶ Properly formulated mixtures of organic titanium derivatives may be used to alter the surface property of paper from its normally hydrophilic to a hydrophobic nature. This property of these unique chemicals is due to their remarkable adhesion to polar surfaces. The most common use for this property is in the preparation of various laminates of polyethylene to such materials as paper, cellophane, glassine and "Mylar".

▶ Because of the ability of the organic titanium derivatives to react with and cross-link other polymers containing reactive hydroxyl and amino groups, they may be used to expedite the rate of drying of different coating compositions.

(Continued in February issue)

*Reported at the Tenth Plastic-Paper Conference of the Technical Association of the Pulp and Paper Industry.



TORKEL KORLING

FINAL INSPECTION . . . *Erecting floor, Beloit Iron Works.* / *For further details, please turn the page.*

FINAL INSPECTION

The photograph on the preceding page shows a portion of the main erecting floor and adjacent shipping area at Beloit Iron Works, Beloit, Wisconsin. The main erecting floor, over 500 feet long, provides the floor space, the overhead clearance, and the heavy-duty bridge cranes needed to assemble and check the completed sections of a paper machine. Simultaneous erection of super calender, dryer framework, and press section provides clear and dramatic evidence of size and facilities.

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CURRENT COMMENTS

Big labor and big business . . . the merger trend . . . and a record

Labor has responsibilities as well as rights. The merger of the CIO and the AF of L (with their combined membership of some 15,000,000) will involve studies of monopolistic possibilities.

Such were the highlights of the first week of December at New York, when the two great unions became one, and when the National Association of Manufacturers held its annual meeting. Conferences between top-drawer leaders of both groups—involving political movements and efforts to achieve a satisfactory contact between labor and management as represented by the two organizations—were by-products of the two conventions.

The paper industry's part in the two conferences was in the fact that Cola G. Parker, retired chairman of the board of Kimberly-Clark Corp. and former president of the American Paper & Pulp Association, was elected president of the NAM.

Seldom has such attention been given by the metropolitan press to any such feature of the annual meeting of the manufacturers as was given to Mr. Parker's public address and to his prolonged conference with the sharpest witted financial writers of the New York papers.

The industry's high status

That his year in the office will be devoted in large measure to a study of the new situation as regards a unified control of all organized labor was definitely stated by Mr. Parker. It was evident from his interview that he held in retrospect the fact that England today is slowest of the world powers to regain business prosperity in the post-war period, that very fact being recorded as a handicap hanging over from the unprofitable years of a British labor government. The talk of politics during the CIO-AF of L convention was an outstanding feature of the meeting.

The election of Mr. Parker to his new office is a renewed evidence of the high status which the paper industry has achieved in the nation's business-industrial picture, with its present ranking as fifth in the total annual value of products. His opposition to the growth of Big Government was pointedly sparked by the statement that the nation, led by business, should cease looking to the government for security, and that the government has nothing to give the people which it did not take from them in the first place.

Washington's goldfish bowl

In the future, if you are going to take a patriotic job with the government to serve as a business consultant "without compensation," you must file with the government a statement of everything you own of a business character and must revise your records of such holdings every six months. This is the point at which the campaign against business consultants in government has arrived as a result of attacks by Washington politicians. If you are not willing to serve the government with your private affairs displayed in a goldfish bowl, don't take such a job. That is why many people believe that the political trend in Washington is to place second-class citizens—with nothing except salary from Uncle Sam—in charge of the world's biggest business, the United States.

Newsprint in the news

The newsprint situation has become acute since many companies have announced price increases. Some months ago economists said that the production of newsprint was in approximate balance with demand. An increase of advertising and consequent increased consumption ran in the neighborhood of 10 per cent above any expected demand for tonnage. It is for this reason that some companies are beginning a friendly rationing of tonnage allocated to customers and are reporting several extensive additions to United States production capacity. With the use of bleached kraft in the South, the nation will not for long be at the mercy of Canadian producers. Subsidization of new mills to serve the newspaper publishers but financed by the public is a long way in the future—if ever.

From forest to consumer

The trend toward mergers in the industry, by which manufacturers of the basic paper are reaching out into consolidation with the immediate consumers—such as paper box makers—continued to be in evidence. Integration of facilities from the forest to the eventual consumer is the story of the day. Such movements as those reported from day to day by such companies as St. Regis, Crown Zellerbach, Mead, West Virginia, National Container and the like are not the exception but are becoming normal to the industry. The ultimate result is a reduction of total costs, instead of a pyramiding of expenses from the root stock to the ultimate product, which can be passed on eventually to the public except as it is retained for less prosperous days if there should be a diminution of demand. Backlogs are good for all, from the mill to the worker to the consumer.

Everywhere in the industry is seen a trend toward greater combinations of basic paper and board, and chemicals—such as the synthetic resins, rubber latex and plastics of various types. The water resistant papers were merely the forerunner of a constantly expanding use of special papers. Chemical products unknown to the layman are becoming staples in the paper mills. On the other hand, the mills are spending fortunes in research to find uses for what was once waste material. Millions are being expended in plants for the production of tall oil fatty acids and synthetic resins alone.

Latest production figures indicate that this year will see a paper and board output of over 29,000,000 tons, with prospects of a normal increase next year of 5 per cent over this year's hitherto untouched record.

NEWS of the INDUSTRY

WHEN UNDER CONSTRUCTION, the eight-acre 20,000,000-gal. lagoon at Falls Paper & Power Co. Inc. in Oconto Falls, Wis., looked like this. Today, the firm pumps into the basin all liquor produced in excess of what daily analysis shows the river can handle without impairment of stream conditions

NEW WASTE TREATMENT plant at the Covington, Va. mill of West Virginia Pulp & Paper Co. Using the familiar activated sludge process, BOD of the mill effluent will be reduced 80 to 90 per cent before being discharged. Included in the installation are a 100-in. Dorr clarifier and two 175-in. Currie Claraetors

1955: a year of increased activity

Wisconsin Mills Lead Way in Nation's Stream Improvement Effort

THROUGHOUT THE UNITED States and Canada during 1955, the pulp and paper industry took another whack at the problem of stream improvement. Leading the way in this multimillion dollar effort have been the Wisconsin mills which, through the Sulphite Pulp Manufacturers Research League, have for many years fought with money and research the "pollution problem."

And in other parts of the nation where the problem is particularly severe pulp and paper plants—practically as a body—have devoted millions to finding a solution. Through the National Council for Stream Improvement, they have realized progress not even contemplated a few short years ago.

In a recent issue of the *Milwaukee Sentinel*, Stanton W. Mead, president of Consolidated Water Power & Paper Co., reported Wisconsin's 1955 efforts: "Throughout 1955 the mills comprising the Sulphite Pulp Manufacturers Research League have continued making headway with the twin problems of spent sulfite liquor utilization and stream improvement. Thirteen of these mills are in Wisconsin, one apiece in Michigan and Minnesota. . . ."

Mr. Mead, who is president of the Sulphite League, described the workings of the research group with special emphasis on 1955 developments. "All League work," he said, "bears directly on practical solution of sulfite industry by-product utilization and disposal problems. Today, four Wisconsin member mills operate full-scale experimental plants that can process all of their collectible spent sulfite liquor. All four use techniques developed and perfected through League research. A fifth member mill processes spent liquor by methods developed in its own research department."

A Coast-to-Coast Effort

In a recent report to THE PAPER INDUSTRY, Russell L. Winget, executive secretary of the National Council for Stream Improvement, outlined major steps taken during the past year. The information was taken from a paper prepared by Harry W. Gehm, technical advisor, and Nicholas J. Lardieri, regional engineer, for the National Council.

In their discussion Gehm and Lardieri pointed out that five years ago a National Association of Manufacturers survey of water usage and waste treatment in industry showed that 37 per cent of all paper mills in the United States had waste treatment facilities. A recent survey of 329 mills by the National Council for Stream Improvement indicated that 180—or 55 per cent of the mills surveyed—have constructed waste treatment plants of one type or another. And based on this survey, it can be conservatively estimated that the industry has spent in the neighborhood of $70,000,000 for waste treatment plant construction over the past 10 years.

Developments range from coast to coast, some of the more important ones being:

West Virginia Pulp & Paper Co., Covington, Va.—Has placed in operation an accelerated aeration treatment plant that is designed to treat up to 24,000,000 gal. of kraft mill effluents daily by modification of the activated sludge process. It is expected to retain a BOD reduction of between 80 and 90 per cent.

Schmidt & Ault Paper Co., York, Pa.—Has installed a clarifier that is part of a complex system for treating paperboard mill effluent to a degree where the bulk of it can be returned to the process for

Wisconsin pioneers in stream survey technique

A. J. WILEY
Technical Director
Sulphite Pulp Manufacturer's Research League

IN 1955 A SUBSTANTIAL start in a new direction was made in Wisconsin that promises to contribute a great deal to the eventual working out of stream improvement where spent sulfite liquor is involved—or, for that matter, any other industry effluent in which BOD is the principal consideration.

The sole object of sound pollution control is to maintain the stream in satisfactory condition, not to take out X-thousand gallons of spent sulfite liquor or other effluent. No available treatment method can get rid of all the objectionable matter, and the cost rises steeply for each percent of material removed after the relatively easy first stages of treatment. Since every stream has a natural capacity for self-purification, any program to be economically sound must let the stream do for itself as much as it can at any given time without overloading. In terms of the industry's job, this means that a mill's proper goal is to keep out of the river as much of its effluent as is needed to keep the stream in good condition. Anything beyond that would contribute nothing and would be economic waste.

Everybody who works with stream improvement knows that the regenerative capacity of a stream is enormous, and that it fluctuates tremendously by seasons. Relatively little, however, is known quantitatively about this regenerative capacity. Lack of such quantitative data means that neither the public authorities charged with pollution control nor the mills that are trying to find ways to improve their own performance can have a clear idea of precisely what they must accomplish in terms of outflow to maintain a stream in satisfactory condition.

To learn more about the working capacity of streams is, therefore, a major need. During the past season, starting in April and ending in October, cooperative stream surveys and laboratory studies have been carried on by the Wisconsin Committee on Water Pollution and the Sulphite Pulp Manufacturers' Research League. Teams of technical men have worked together, with representatives of both groups in each boat taking samples, in the field laboratories and in the base laboratories. On each stream thus surveyed the local sulfite mills have supplemented the state and League forces with technical people. And on some streams, there have been additional biological studies conducted by the Institute of Paper Chemistry and the local mills. No one group by itself could have done so thorough a job.

WISCONSIN'S state-industry cooperative stream survey gets underway on the Wisconsin River

Four surveys were conducted on the Fox River down the full length of the stream. Two were made on the Wisconsin, supplementing a full-scale test run made there the previous summer by League and industry personnel with state representatives on hand as observers. One was made on the Oconto and one on the Flambeau.

Data from these surveys and from the subsequent laboratory studies have been compiled and are currently under analysis. When these are completed during the coming months, both the state and the industry will have more actual, basic knowledge of these streams and their condition than was ever available to anyone. This year's compilations will serve primarily as a baseline from which to gauge future work. With mills on all of these streams conducting major programs of utilization and/or treatment of spent sulfite liquor, it is expected that similar surveys in successive years will provide definite quantitative knowledge of just how much working capacity each stream possesses under varying conditions of flow and water temperature. With these facts in hand, the industry should achieve a much better idea of the limits within which stream discharge must be restricted and the extent of the pollution-abatement works which must be installed to restore impaired streams to satisfactory condition.

reuse. Side hill screens and deaerators precede the clarifiers, and a Hardinge rapid sand filter is used to polish the effluent so that it is sufficiently clean for use in high-pressure services. The filter is of the automatic continuous back wash type.

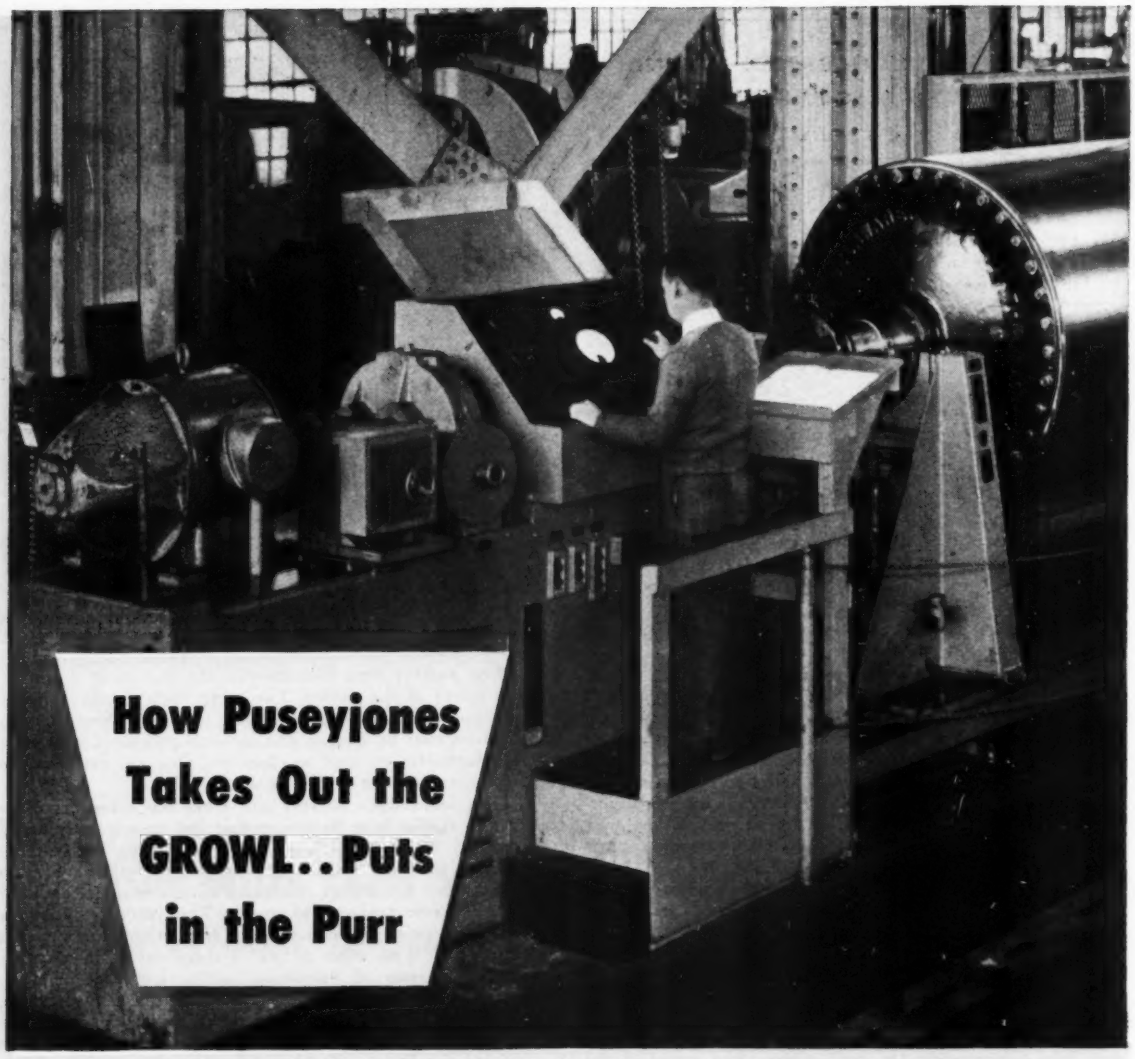
Crown Zellerbach Corp.—Is using flotation at one of its mills for the clarification of white waters, particularly those produced in the manufacture of filled papers. In the operation of these devices, glue or activated silica is generally employed, together with alum as a coagulent. Such devices, properly installed and operated, can produce effluents having a suspended solids content as low as 0.2 lb. per 1000 gal.

New York & Pennsylvania Co., Johnsonburg, Pa.—Has in use a large and complicated waste treatment plant at its mill, which produces both sulfite and soda pulps, deinks magazine stock and has a multiple-machine operation. Each machine is equipped with savealls, and the combined machine effluents are then conducted to a large cyclator. Here, the combined machine waters are treated with alum and activated silica and further clarified. A large percentage of this water is returned to the paper machine rooms for reuse and the remainder discharged to the common sewer. A portion of the sulfite waste liquor is evaporated and sold and the remainder lagooned seasonally. Sulfite wash water, soda mill effluent and deinking washer water are also discharged to the common sewer.

International Paper Co., Panama City, Fla.—Is removing suspended matter from kraft mill effluents in earthen bank basins equipped with sludge collection mechanisms. Such installations are reported to save considerable cost where large volumes of effluent must be treated, since the mechanisms can be built with diameters of more than 200 ft.

West Virginia Pulp & Paper Co., Tyrone, Pa.—Is discharging underflow from rectangular clarifiers to a sludge drying bed. After thickening, the supernatant is allowed to drain and the sludge to dry partially. It is then removed with high lifts and carted to a dumping area.

National Container Corp., Valdosta, Ga.—Has installed oxidation lagoons. Because the mill is located on a stream affected by the tide, the lagoons are employed for discharge control regulation as well as oxidation. The plant discharges from the headwaters of the Sacred Suwanee River and therefore must be highly stabilized. High-degree solids removal followed by multiple oxidation basins and flowage through a series of pools and riffles for a distance of 7 miles reduces



A Puseyjones engineer calibrates a paper roll on the fast and accurate Gisholt Dynetric Balancing Machine.

Like every machine that Puseyjones builds, the new Fourdrinier now being built for Southland Paper Mills will be in dynamic balance . . . vibration-free at every speed. At the Puseyjones plant, every rotating part, large or small, is being checked out on this Gisholt Dynetric Balancing Machine . . . electronically balanced to the closest tolerances.

Speeds and tonnages go up, when vibration goes out. At Puseyjones, scientific, precision balancing takes out the growl, puts in the purr. In a matter of seconds, unbalance vibration is picked up, amplified, and recorded. Like a doctor reading an electrocardiogram, Puseyjones engineers read the electronic tracing, compute the amount of unbalance, and pinpoint its location. Armed with this data, adjustments to eliminate vibration are easy.

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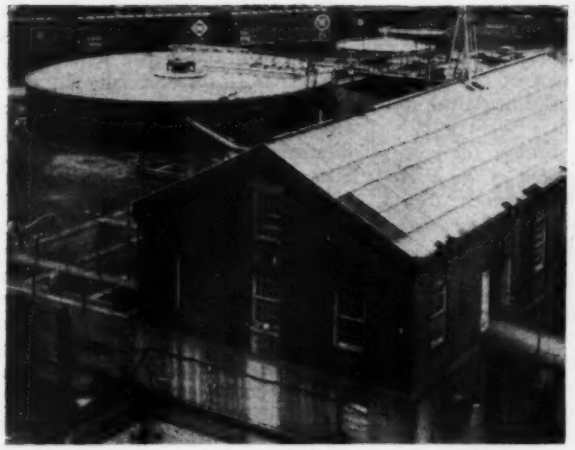
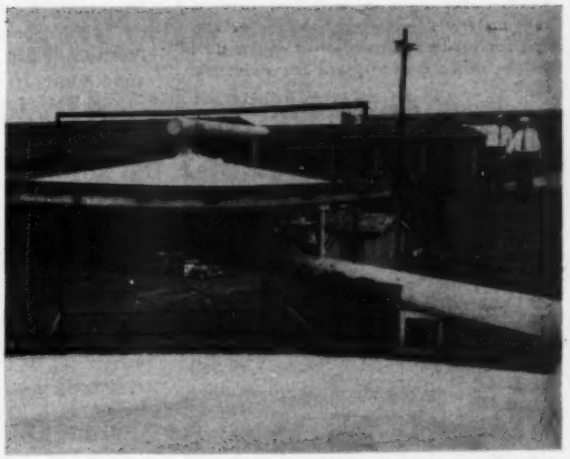




80-FOOT SETTING tank and de-aerator pan, latest additions to Ohio Boxboard Co.'s water clarification system. These units went into operation in April 1955. Prior to that, two 50-ft. settling tanks had been rebuilt. This most recent stream improvement project at Rittman had at total cost of $95,000.

Between 1949 and 1951 the firm installed six plate and frame filters that can clarify continuously 1200 gpm of mill effluent sufficiently to permit reuse of the water as a substitute for fresh water. The cost of this installation was $166,000.

Internal mill changes were made during 1951 and 1952, including installation of new cisterns, revised piping layouts and recirculating pumps to permit reuse of as much water as possible to replace fresh water use. The cost of these changes was $83,000.

Between 1949 and 1954 this program resulted in a 68 per cent reduction of solids in the water being returned to the creek. It was expected that the new settling tank would realize an additional reduction of 23 per cent. Plans call for the construction of four lagoons at an approximate total cost of $60,000 to take the mill effluent from the settling tanks and hold it approximately eight days.

At the left above are the settling tank and de-aerator pan; in the foreground is the building housing the water filtration system. At the right is shown a close-up of the effluent water being de-aerated prior to entering the settling tank

the BOD of this effluent to about 10 ppm during the low-water period. A similar installation is found at the **Weyerhaeuser Timber Co.** mill in Everett, Wash.

Southland Paper Mills Inc., Lufkin, Texas—A modification of the activated sludge process is used for kraft effluents. Following experimentation at Louisiana State University (in cooperation with the National Council), a pilot plant was constructed by the industry at **Macon Kraft Co.** in Macon, Ga., and another by **West Virginia Pulp & Paper Co.** at Covington, Va. Promising results were obtained, and an experimental unit capable of treating 1000 gpm of decker seal pit water was put into operation at Southland Paper Mills. The treatment unit supplements oxidation lagooning. Treatment of part of the waste by the accelerated aeration process speeds oxidation of the combined effluent in the lagoons.

Sonoco Products Co., Hartsville, S. C.—Is using land disposal of dilute neutral sulfite semichemical liquors. Unintegrated neutral sulfite semichemical mill effluents has long been one of the perplexing problems in pulp mill waste disposal. Although most semichemical pulping is integrated with the kraft process, so that the liquor can be burned, there are quite a number of mills where this process alone is employed. Recovery for these units is not an attractive proposition since the units are small, the liquor low in chemical content and recovery more complicated process-wise. However, five mills are equipped with such units. At Sonoco Products the type of equipment employed for spray irrigation is used in this installation. This technique does not lend itself to broad application because of the large areas of pervious soil required for even a very small mill. The experimental unit at Hartsville was designed to handle 1,000,000 gal. per day of machine water and has been in operation for about a year. To date, the results obtained have not been as promising as those obtained for kraft effluents.

Hammermill Paper Co., Erie, Pa.—Experimentation with the "Zimmerman Process" for handling neutral sulfite semichemical liquor is underway at a large-scale pilot plant. This process is basically one of wet combustion, in which the liquor is heated in the presence of high-pressure air and the organic carbon oxidized to carbon dioxide and water.

Puget Sound Pulp & Timber Co., Bellingham, Wash.—Is using the spent liquor fermentation processes to produce ethyl alcohol. Fodder yeast is manufactured by the same process at two Wisconsin mills.

Potentially Valuable Materials

Continuing his report on Wisconsin's 1955 progress, Stanton W. Mead declared: "Fifteen years' experimentation and experience have convinced most Wisconsin sulfite manufacturers that the only long-term solution for this problem is in extracting the potentially valuable materials contained in spent sulfite liquor and utilizing these for socially valuable purposes. Any process of dealing non-pollutionally with sulfite liquor, whether utilization or mere disposal, is costly to operate. The mill that successfully obtains from its particular process by-products to pay for the processing expense will thereby gain a major competitive advantage over less progressive mills. The full-scale utilization processes now installed by four Wisconsin mills at an investment totalling more than $8,000,000 were adopted in full recognition of this situation. Not all of these by-products plants are as yet self-supporting, but the mills are confident that eventually they will learn to operate them at a profit.

"Use of sulfite roadbinder has increased substantially. Representative mills throughout the state report gains ranging from 10 to 90 per cent. Sale of concentrated 55 per cent-solids roadbinder to more distant areas reached a new high volume, but there are indications that growth of this product may hereafter be limited by transportation costs.

"As yet incomplete figures on quantities of liquor treated by soil filtration, ponding or lagoons show large increases over last year for this disposal technique. But, soil filtration also appears to be approaching its limit of growth in this state."

Activity in Wisconsin

Among the projects listed by Mr. Mead for Wisconsin during 1955 were the following:

Charmin Paper Mills Inc., Green Bay—In early fall completed its new $3,200,000 plant with capacity to utilize the carbohydrates from the mill's entire collectible liquor output for the manufacture of food and feed yeast.

Consolidated Water Power & Paper Co., Interlake Mill, Appleton—Is well into its third year of evaporating all collectible liquor. Much of the 55 per cent-

solids concentrate is sold for chemical raw materials, adhesives and dispersants and for roadbinder, while the rest is used in the mill's power plant for industrial fuel.

Falls Paper & Power Co. Inc., Oconto Falls—Is using its new eight-acre 20,000,000-gal. lagoon, to which it pumps all liquor produced in excess of what daily analysis shows the river can handle without impairment of stream conditions. The plan is to empty the lagoon's contents during spring run-off when the stream can carry off this quantity of liquor and still maintain adequate dissolved oxygen levels. The mill used more than 10,000,000 gal. of liquor for roadbinder in 1955.

Flambeau Paper Div., Kansas City Star Co., Park Falls—Used 90 per cent more roadbinder than during 1954, disposed of 500 per cent more liquor through its newly expanded experimental spray irrigation system and added a large soil filtration area.

Kimberly-Clark Corp., Kimberly—Spent liquor holding pond capacity increased by 50 per cent.

Kimberly-Clark Corp., Niagara—Plans are complete for a 40-acre spray area to receive spent liquor at rates at which the soil will dispose of the greatest quantity of organic material by filtration.

Marathon Corp., Northern Paper Mills Div., Green Bay—Evaporating all collectible liquor. Concentrate is sold for chemical raw materials, adhesive, dispersants and roadbinder. The remainder is used for industrial fuel.

Rhinelander Paper Co., Rhinelander—Increased quantities of spent sulfite liquor are being utilized for the manufacture of torula yeast with the completion of a new storage unit at the sulfite pulp mill. The 125,000-gal. tank doubles the mill's former liquor storage facilities, assuring a capacity flow of raw material to the adjoining plant of Lake States Yeast Corp. and a corresponding cut in liquor lost to the Wisconsin River. Yeast output may be increased as much as 10 per cent. The concentrate is sold for chemical raw materials, dispersants and adhesives, while the remainder is burned as industrial fuel.

Revolutionary New Process

Elsewhere in North America, stream improvement is uppermost among the many community relations goals of the paper industry. A recent joint statement by McGill University and the Pulp and Paper Research Institute of Canada reveals a "revolutionary" new process that may find use in the recovery of valuable materials from spent liquors of chemical wood pulp manufacture.

Dr. W. H. Gauvin of McGill reports that the new technique—using equipment of simple design—features the atomization under pressure of the waste fluids in a specially constructed chamber. It may eliminate the former evaporation and drying processes that are time-consuming and expensive. "Sulfite spent liquors in particular can be processed quickly through a series of physical operations and chemical reactions," Dr. Gauvin declared, "to yield some 70 per cent of the sulfur originally present plus other materials of potential value."

More than 90 test runs on the process have been conducted at the Pulp and Paper Research Institute's laboratories, and the process is believed to be commercially feasible.

Progress in Maine

Dr. Ashley S. Campbell, dean of the College of Technology at the University of Maine in Orono, has announced the signing of a contract between the university and the National Council for Stream Improvement Inc., under which the school will conduct research to develop waste treatment methods applicable to the Maine pulp and paper industry.

Specifically, the university will study methods for treating the waste liquor from sulfite pulp mills with particular reference to river conditions in the State of Maine.

The first phase of the work will include a critical evaluation of proposed and existing methods of treating pulp mill waste, both in this country and in Europe, to determine their applicability to specific conditions that exist in Maine. This study will be under the direction of the staff in the department of chemical engineering, where teaching and research studies in pulp and paper technology are carried out.

NEWLY EXPANDED mill of St. Marys Kraft Corp. in St. Marys, Ga.

St. Marys Completes Expansion Program

St. Marys Kraft Corp. has completed a program of expansion in the production of both bleached and unbleached kraft papers at its mill in St. Marys, Ga. The firm, a subsidiary of Gilman Paper Co. of New York, N. Y., now has two paper machines in operation.

No. 2 is a Beloit Iron Works fourdrinier designed especially for the manufacture of bleached sulfate paper and board. The wire width is 236 in., affording a maximum trim of 216 in.

This latest addition to the fully integrated plant on the St. Marys River—which also includes the multiwall bag plant of Kraft Bag Corp., another Gilman subsidiary—is completely fitted with auxiliary equipment that permits the manufacture of high-quality bleached sulfate paper and food container board.

A highly efficient chemical make-up system is connected to the machine to provide a wide range of treatment for the paper at the wet end, size press, and/or calender stack water boxes.

No. 2 is housed in a new brick building built especially for its installation, parallel and adjacent to the structure that houses No. 1 paper machine.

Charmin Buys Bankrupt Michigan Paper Mill

Charmin Paper Mills Inc. of Green Bay, Wis., has purchased the bankrupt Paper Corp. of America mill in Cheboygan, Mich. According to Irwin Kurtz, United States referee in bankruptcy at New York, the auction sale price was $600,000.

A spokesman for Charmin reported that the Green Bay firm expects to devote four to six months in bringing the plant into sufficient operational order. Rehabilitation was to begin immediately. Charmin will use Paper Corp.'s facilities to meet its orders for towels, napkins,

tissues and other household papers.

The new owners have deposited a down payment of $60,000 and were to deposit a similar amount when the sales contract was drawn. The balance is to be paid in cash when the final transfer of the property is completed.

The Michigan mill, which once employed more than 200 persons, has been closed since June 1953. It produced sulfite papeteries, ledger, bond, index and manifold papers. Equipment includes two 136-in. paper machines with trim widths of 124 in., a 100,000-lb. deinking plant, six 2000-lb. beaters, five E. D. Jones jordans and two washers.

POUCHPAKS made by Riegel Paper Corp. that will aid in food preservation during Admiral Byrd's South Polar expedition

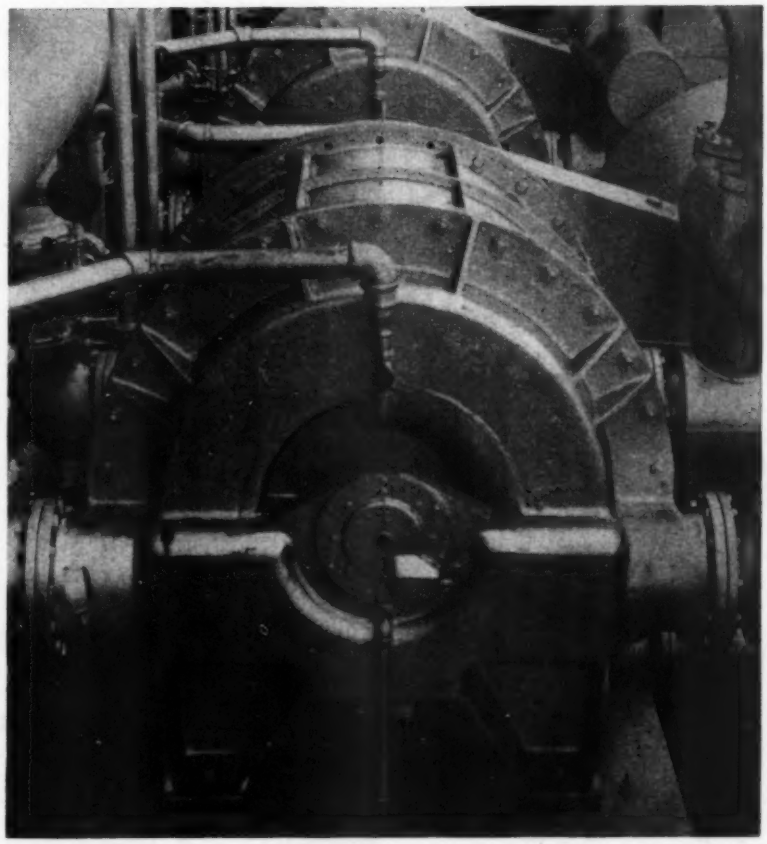
Riegel Paper Pouches to Protect Food on South Pole Expedition

The U. S. Navy's 1955-59 Antarctic expedition under the leadership of Rear Adm. Richard E. Byrd is on its way to Little America. Playing an important role in the venture are paper food pouches designed to preserve supplies in the sub-freezing climate at the bottom of the world as well as during the voyage through tropical waters before reaching the barren icelands.

New developments in concentrated, powdered and dehydrated foods, as well as fresh-frozen sirloin steaks, will contribute to the success of the expedition. Dried fruit will be included in the special trail rations.

These dried fruit items will be pro-

High machine speeds? High temperature headbox stock? You need NASH Vacuum Pumps!



Air from the suction rolls on paper machines carries with it substantial quantities of moisture. This considerably reduces the effective air handling capacity of any vacuum pump except the Nash. In the Nash Vacuum Pump, because of the unique principle of operation, the bulk of this vapor is effectively condensed inside the pump. The total capacity of a Nash is therefore increased.

When you specify a Nash Pump it can be closely sized to the job. It is not necessary to select an over-sized unit, because the rated capacity of the Nash may be relied upon.

That is one of the reasons why Nash Vacuum Pumps are installed in over a thousand leading Paper Mills. An engineer from Nash will be glad to survey your mill, and make recommendations, entirely without obligation to you.

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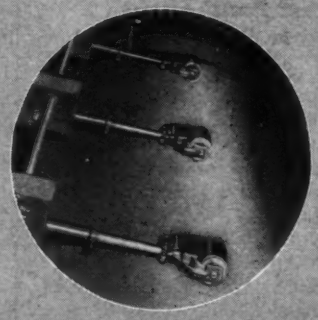

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Manufacturers of: Hurletron R.O.P. Color Registration Controls; Automatic Controls of Caliper and Weight on Paper and Board; Center Line and Side Web Guide Controls; Cut-Off and Back-Up Controls; Slitter Controls; Moisture Controls.

tected by Riegel Paper Corp.'s newly developed Pouchpak, a trademarked name for certain papers combined with various films. The papers are then made into pouches by the packer in the measuring and filling operation on standard packaging machines.

This particular grade of Pouchpak is a combination of special bleached kraft, foil-laminated and polyethylene-coated by Riegel. It was flown in rolls to Wisconsin, where the stock was printed by Vanant Products at Tomah. The pouches were then packed with dehydrated fruit and nuts by Wexler Bros. of Minneapolis.

Minnesota Mining Buys Control of Hartford City

Minnesota Mining & Mfg. Co. of Minneapolis has purchased a controlling interest in Hartford City (Ind.) Paper Co. The Indiana firm will be operated as a subsidiary with no changes in management or policies.

Herbert P. Buetow, president of Minnesota Mining, cited as the primary reason for the purchase his firm's need for an assured additional source of raw material for the office duplicating paper it manufactures. Hartford City pioneered in the development of protective wrapping papers.

Potlatch Forests Starts up Largest Board Unit

A Black-Clawson Co. cylinder board machine 220 in. in width has been put into operation by Potlatch Forests Inc. at its new pulp and paper mill in Lewiston, Idaho. Said to be the world's widest board machine, the unit will increase daily production by 200 tons.

The Potlatch machine incorporates many new design features. The wet end comprises seven 60-in. diameter and 220-in. face molds mounted in vats that are equipped with built-in Hydronamic inlets and a self-contained exhauster system.

The press part consists of a 36-in. suction return drum press, four overhead primaries and three main presses. The dryer section is made up of sixty-four 60-in. diameter dryers. The machine has two openside calender stacks. Paperboard is wound on a B-C Autoflyte 42 reel. Also included in the installation is a duplex cutter-slitter and a No. 35 slitter-rewinder.

A six-tube Pandia continuous di-

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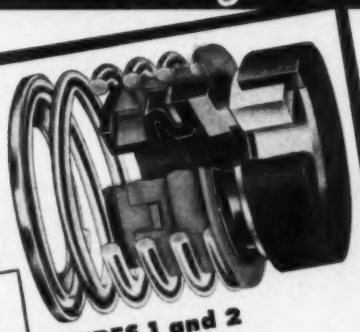

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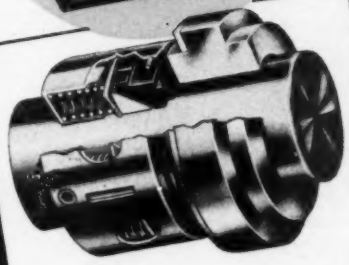

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There is no better way to cut liquid handling costs than with "John Crane" Seals. They are specially engineered for the Paper Industry to provide these important operational savings:

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Ranging from the Types 1 and 2 (for services where synthetic rubber is suitable) to the Type 9 (with sealing members made of DuPont Teflon to handle any industrial chemical or corrosive) . . . there is a "John Crane" Seal that can be adapted to your individual conditions.

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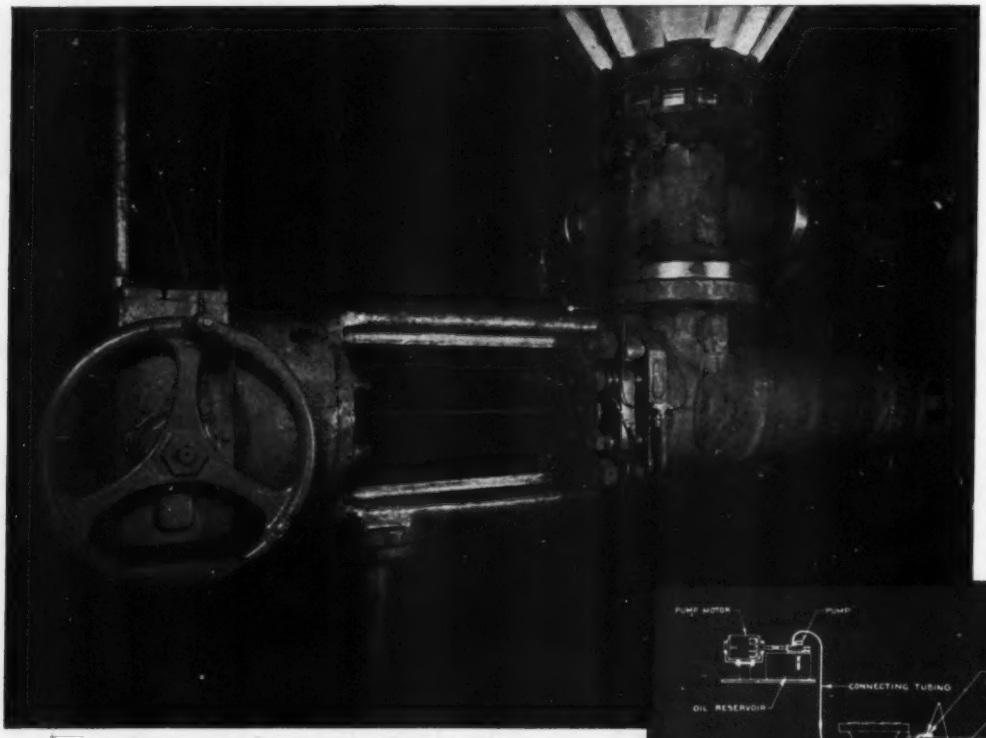
YARWAY DIGESTER BLOW VALVES with AUTOMATIC LUBRICATION



One of a battery of Yarway Digester Blow Valves, motor-operated, with automatic lubricators, in a large Washington pulp mill.

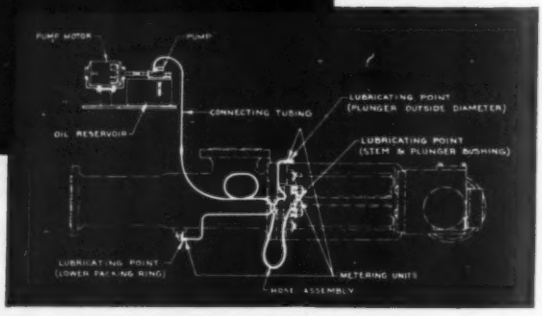


Diagram showing arrangement of Yarway Automatic Lubricator on Yarway Digester Blow Valve.

..help increase production, cut maintenance and save manpower

Automatic lubricators on Yarway Seatless Digester Blow Valves add new cost-saving and labor saving features to digester operation.

Push-button control of these valves also provides automatic lubrication of them at the *right* places . . . at the *right* time. Result—less maintenance, fewer production delays, release of manpower for other productive work.

Reports on low operating cost experiences from pulp mills using Yarway Digester Valves, are impressive, too. One large mill found the resultant *savings in operation and maintenance the first year more than paid for the cost of their new 4 Yarway Digester Valves.*

Yarway Seatless Digester Blow Valves are either motor or hydraulically operated. All are remote controlled—designed for clean, free discharge and tight shut-off.

For full information on Yarway Seatless Digester Blow Valves, write for Bulletin B-441. No obligation.

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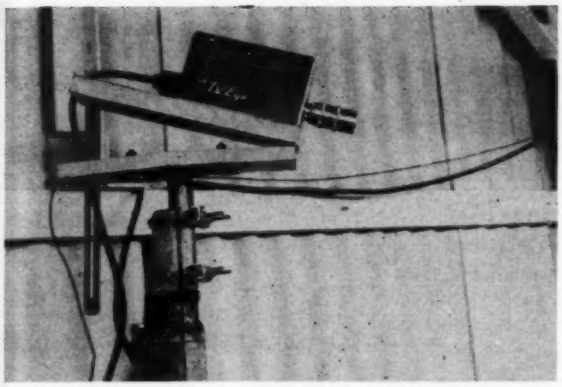
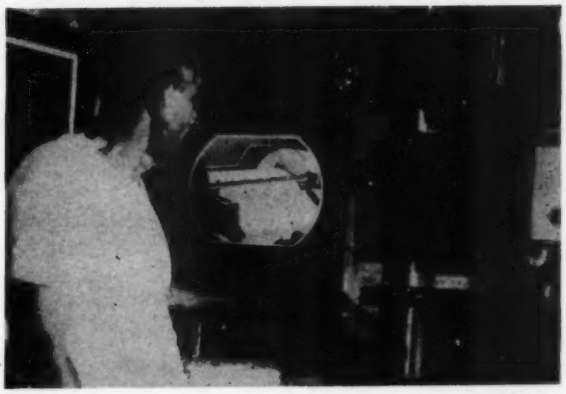
BRANCH OFFICES IN PRINCIPAL CITIES

DIGESTER BLOW VALVES



KVP CAMERA is mounted on fifth floor of company bleach plant. Swivel base permits it to be aimed at either one of two Oliver machines



BLEACH PLANT operator, Lee Dean, watches TV screen at station two floors below actual operation to determine whether pulp is flowing properly

Station KVP-TV on the Air

A round-the-clock television program is broadcast daily at KVP Co. in Kalamazoo, Mich. It carries no big network shows, no big name stars and no commercials. Its sole function is to keep an eye on an important papermaking operation.

A few months ago KVP joined the growing list of companies that have successfully adapted television to industrial use. At that time, the Michigan company installed an RCA closed TV circuit. The camera, located on the fifth floor of the bleach plant, is trained on the Olivers.

On the receiver—two floors below—the TV screen tells the bleach plant operator whether the proper flow of pulp is being maintained through the Olivers. Prior to TV, the operator had to climb two flights of stairs at regular intervals to keep tab on the operation.

In a recent statement, a company spokesman declared, "Though KVP's miniature television network can't compete in entertainment value with the major networks, it performs an important job for the company by keeping constant watch over a vital phase of the papermaking process."

News of the Industry . . .

gester system processes the wood chips into uniform unbleached pulp.

In addition to the pulp mill equipment, Black-Clawson, through its Shartle Div., furnished six jordans, five Selectifier screens, vat pumps, agitator equipment and a Duopulper broke pulper.

South Florida's First Tissue Mill Schedules Start-Up for March

Pan American Paper Mills Corp. has set March 15 as the target date for initial operation of its tissue mill at Hollywood, Fla., 20 miles north of metropolitan Miami. The plant will be southern Florida's first manufacturing tissue grades.

Located on a 7-acre site, the mill will perform all operations necessary for the conversion of raw pulp high-grade waste paper into tissues, towelling, napkins and other similar paper products. Key piece of heavy equipment will be a fourdrinier machine that will produce a daily 17 tons of napkins and towelling and 10 tons of tissue.

Organizers of the new firm include: President, I. A. Durbin, president of I. A. Durbin Inc. and former vice president of United Metal Corp. of Miami; vice president, Sidney Pepper of West Palm Beach; treasurer, Jerry Krongold, and secretary, Leo A. Gross.

Saskatchewan May Have Paper Industry by 1960

Saskatchewan may have a new $60,000,000 pulp and paper industry by 1960, according to a report submitted recently to the Gordon Economic Commission.

Actual development is contingent upon United States demand for paper, the provincial government said in a brief to the commission. Major drawback is the high cost of shipping the finished product to market areas. If demand continues to increase or transportation costs are reduced, however, "it is reasonable to assume that at least 1000 tons of pulp and paper per day will be produced by 1960."

Stone Expands at Mobile

The Mobile, Ala. paperboard mill division of Stone Container Corp. has launched a $500,000 expansion program. The project will include the installation of equipment for making higher quality products and more grades of boxboard. Storage and shipping facilities will also be improved.

First new piece of equipment to be put into operation under the improvement program was a 1200-gal. Sveen-Pedersen flotation separator to remove fine pulp particles from processing water prior to its discharge.

The mill, which is currently producing about 50 grades of boxboard and containerboard, recently stepped up its production to a seven-day, round-the-clock operation.

Five-Year Expenditure of $216,500,000 Seen for B.C.

Expenditure of $216,500,000 over the next five years for the modernization and expansion of British Columbia's pulp and paper industry has been forecast in a brief presented to the Sloan Royal Commission on Forestry at Victoria.

The brief, submitted by the British Columbia Div. of CPPA, pointed out that the estimated expenditure by eight firms is in addition to the $141,000,000 spent over the past five years.

Forest management legislation must be "sufficiently flexible" to allow the products of this expansion to remain competitive in world markets, the brief declared.

Presented by M. J. Foley, president of the division and executive vice president of Powell River Co. Ltd., it reviewed the industry's 46 years of development. In 1954 its products

had a market value of more than $176,000,000. It stressed the industry's "vulnerability to sudden shifts in the world trade picture."

Westfield River Adds Machine for 30% Increase

Production will be increased 30 per cent this year at the Russell, Mass. mill of Westfield River Paper Co. Inc. The announcement was made by Leroy D. Frisbie, vice president in charge of manufacturing.

Output will be speeded by the installation of a new supercalender and a high-speed rewinder.

Pabco Buys CZ Interest in Fibreboard Products

Pabco Products Inc. of San Francisco has arranged for a loan of $65,000,000 from two New York insurance firms in connection with its purchase of Crown Zellerbach Corp.'s interest in Fibreboard Products Inc. (Prior to the sale, Fibreboard, a producer of paperboard products, was owned jointly by CZ and Pabco.)

Pabco is to pay $37,800,000 for CZ's 50 per cent interest in Fibreboard. The balance of the $65,000,000 loan will be used to refinance long-term debts incurred by Pabco and Fibreboard.

Sidney Roofing & Paper Orders B-C Board Machine

Sidney Roofing & Paper Co. Ltd. of Victoria, B. C., has ordered a new Black-Clawson Co. board machine.

Designed to produce a variety of grades of paperboard—including chipboard, carton stock, bleached manila, patent coated, mechanical and chemical pulpboards, the unit will trim 120 in. and produce a daily 60 tons at speeds of up to 400 fpm. The machine will comprise six vats, a suction return drum press, three primary presses and three main presses—two of which will be forward presses and one a reverse press. B-C crownless press rolls will be used on all main presses.

A dryer arrangement combining both double-deck horizontal dryers and vertical stack dryers will be utilized. The stock dryer framing will be mounted on the basement floor level to provide for future dryer expansion by the installation of new dryers on existing frames below the machine room floor level. Thus, the 42 dryers with which the machine is to be equipped can in the future be expanded to a total of 78.

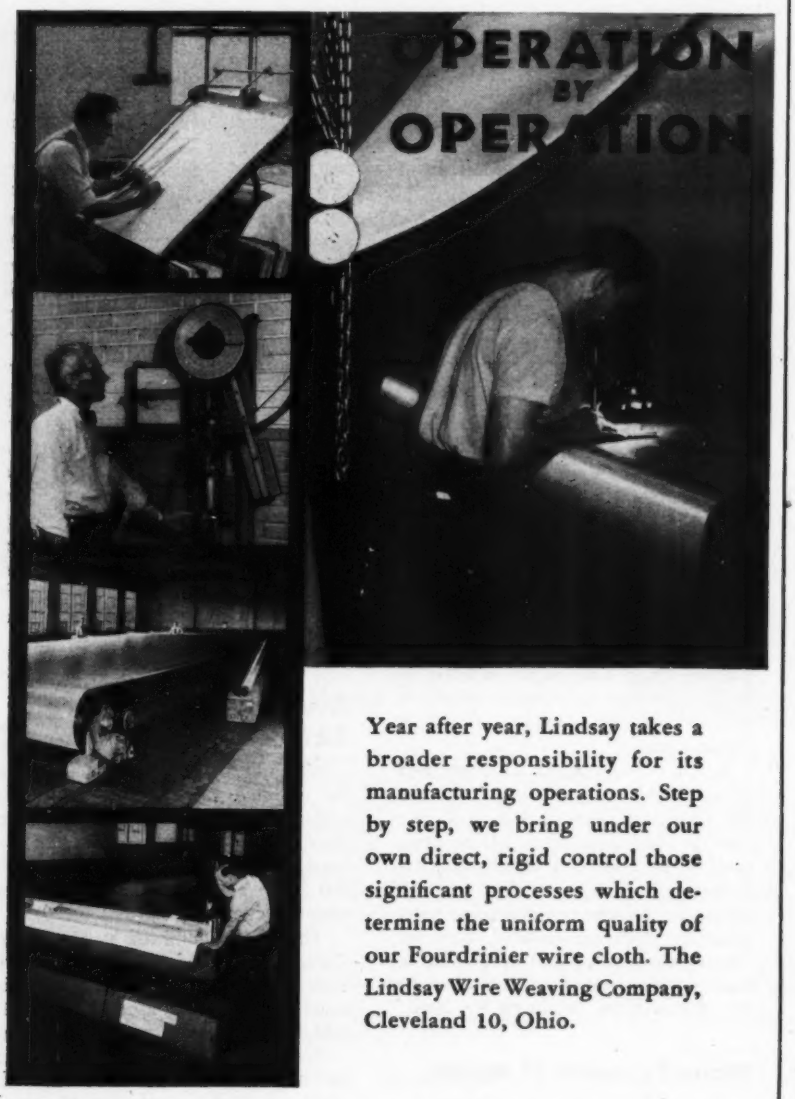
Included in the project are seven-roll and nine-roll calender stacks, together with a B-C Autoflyte reel.

Consulting engineer for the Sidney Roofing & Paper expansion is Sandwell & Co. Ltd. of Vancouver.

Line Material to Expand

Line Material Co. of Milwaukee has announced an $800,000 expansion program for its fiber products plants in Barton, Wis., and Sherman, Texas. The project is in line with the firm's efforts to meet the increased demand for pitch-impregnated paperboard pipe.

The expansion program will include a $500,000 expenditure to double the size of the Barton plant, add new machinery and rearrange the production line set-up for more efficient output. Construction, which was scheduled to begin in December, will add 17,000 sq. ft. of manufacturing

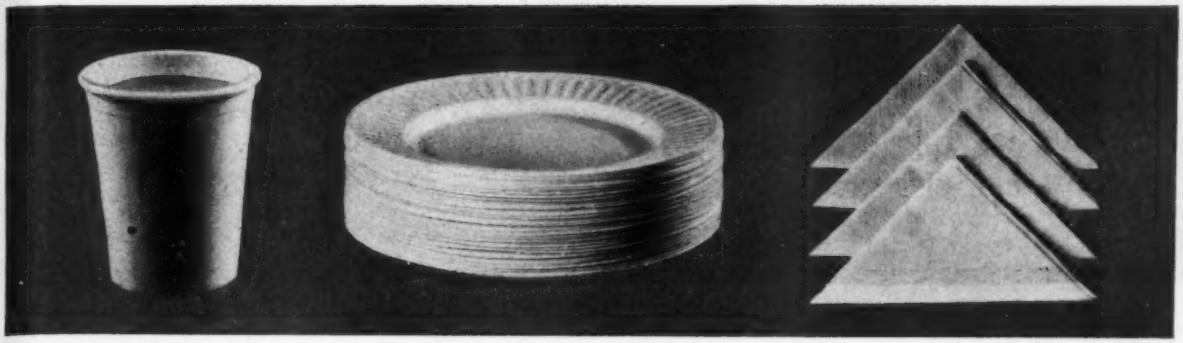


Year after year, Lindsay takes a broader responsibility for its manufacturing operations. Step by step, we bring under our own direct, rigid control those significant processes which determine the uniform quality of our Fourdrinier wire cloth. The Lindsay Wire Weaving Company, Cleveland 10, Ohio.

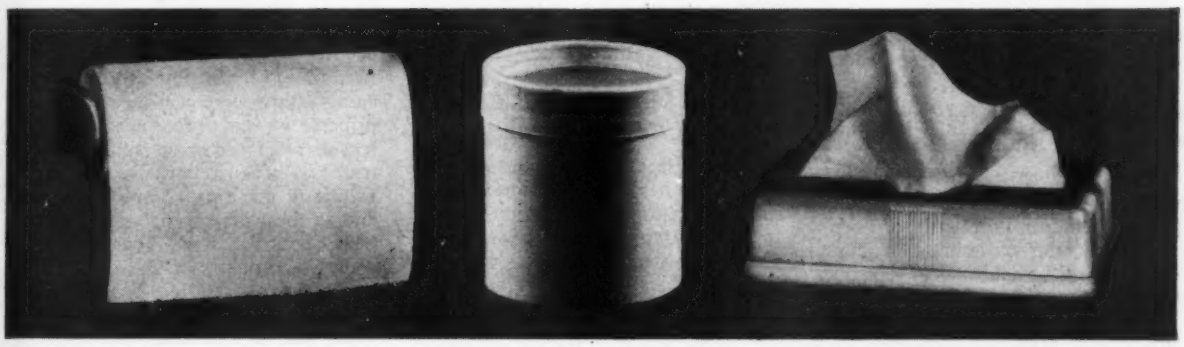
LINDSAY WIRES Since 1904

FOR PAPER MANUFACTURING

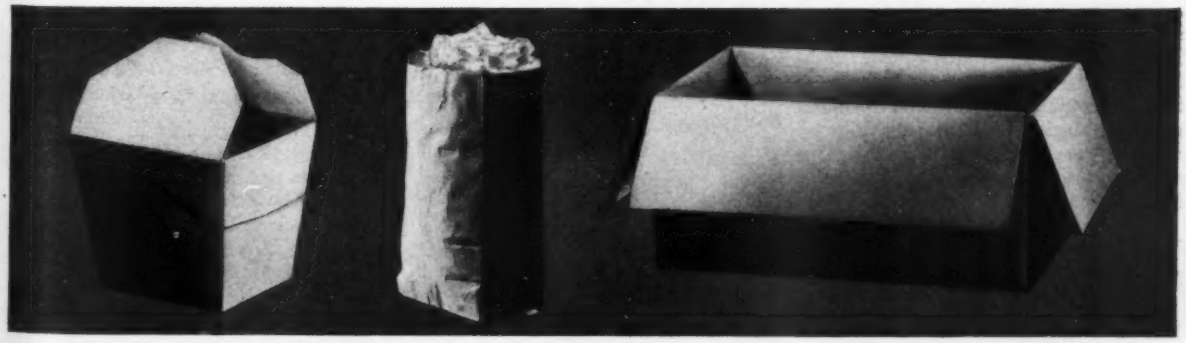
BAGS OR BOXES, CUPS OR CARTONS,



WHEREVER YOU NEED WET-STRENGTH



SPECIFY THE BEST—KYMENE® RESIN



Paper Makers Chemical Department **HERCULES POWDER COMPANY** INCORPORATED *961 King Street, Wilmington 99, Del.*

PPSG-1

News of the Industry . . .

space and 10,000 sq. ft. of warehouse space.

The remaining $300,000 will be spent at Sherman for new production machinery that will make that plant independent of the Barton operation.

Hudson P&P Considers Newsprint Production

A tentative plan for the production of newsprint in Florida has been disclosed by Hudson Pulp & Paper Corp. If realized, the project could result in an annual production of 100,000 tons within two years.

The plan calls for a $25,000,000 expansion of Hudson's present mill in Palatka and depends on whether publishers in the area offer sufficient support.

Enters Cup and Container Field

Hudson has also announced that it will enter the cup and container field in 1956 as a major step in its long-range program of product diversification. The new Paper Cup & Container Div. will be launched next summer at an as yet undesignated site in the New York metropolitan area. This plant will be regarded basically as a pilot operation, with additional points of production to be selected at a later date.

The complete line will include: Pleated water cups, cone-shaped cups and two-piece cups for office and industrial use; cone-shaped and flat-bottom two-piece soda cups for carry-out and send-out luncheonettes; vending machine cups for coffee, cold drinks and fruit juices; ice cream containers ranging in size from 4-oz. to ½-gal.; cups for in-plant and industrial feeding, for hot drinks, soups and casserole dishes; food containers for cottage cheese, cream, pre-cooked and frozen foods, and bulk containers for use by dairies and meat packers.

According to William Mazer, president, in establishing the new division, Hudson Pulp & Paper expects to move swiftly toward a contending position in the nation's $300,000,000 paper cup and container industry.

Cornell Paperboard Buys Chicago Carton Firm

Cornell Paperboard Products Co. of Milwaukee has recently formed a subsidiary firm known as Carton Craftsmen Corp., which in turn has acquired Carton Craftsmen Inc. of Chicago. The latter company is a manufacturer of printed and plain folding cartons.

Carton Craftsmen Inc. was founded some 23 years ago by Joseph J. Geller, who has continued as president and principal owner. Cornell has announced that no changes in personnel or policies are contemplated.

Waste Paper a Growing Factor in Industry: Kumler

Ralph W. Kumler

The paper industry is out to conserve pulp supplies by protecting the quality of waste paper stock. This according to Ralph W. Kumler, director of the Waste Paper Utilization Council.

Between a quarter and a third of the fibrous raw material used in the paper industry is waste paper. This quantity will exceed 9,000,000 tons in 1955. Were it not for the availability of this big stock of raw material, producers of virgin pulp would be called upon to increase their production by this amount. It is estimated that a forest area equal to twice the land surface of the State of Maine would be required to supply the necessary pulpwood for this amount of fiber. fiber.

Waste paper supplies are threatened by the presence of various plastics, adhesives, coatings, wet strengthening agents and the like that do not disperse in the paper mill stock system or otherwise cause trouble. These materials are necessary to the manufacture of much paper and paperboard and to the widening of their markets. The Council has no thought of discouraging such technical developments.

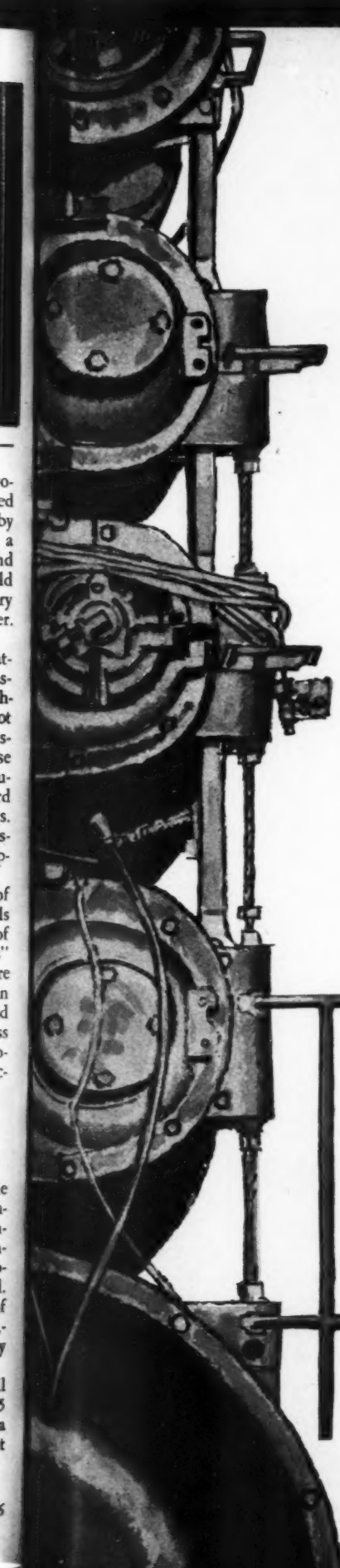
However, it seeks to have users of paper who produce waste use materials that do not detract from the value of the waste; or if "prohibited materials" must be here used, to see that they are withheld from waste paper stocks. In many cases, materials can be modified to render them innocuous without loss of functional properties with the cooperation of the primary manufacturers.

B.C. Forest Products to Increase Size of Mill

Plans for increasing the size of the proposed pulp mill of British Columbia Forest Products Ltd. have been announced by W. A. C. Bennett, provincial premier. The plant is to be located at Crofton on Vancouver Island.

Latest estimates show the cost of the mill will be approximately $36,000,000. Construction is to start early this year.

The bleached sulfate plant will have a daily rated capacity of 425 tons. Previous plans had called for a daily capacity of 250 tons from a plant that was to have cost $25,000,000.



To the mill executive who decides on lubricants—

Three good reasons for specifying STANOIL Industrial Oil

1 The increased demand for paper products results in machinery being operated at speeds higher than rated capacity. Continuous production has placed greater burdens on lubricating oils. Without the best lubrication, equipment failures may occur. Best idea is to specify STANOIL Industrial Oil.

2 Cost of repairs and replacement of parts added to the loss of production, run many times the cost of lubrication. A small investment in STANOIL Industrial Oil is the best possible protection against bearing failures, repair costs and production loss.

3 STANOIL Industrial Oil can be used in a multitude of applications. Inventories of lubricants can thus be reduced and the danger of lubrication failure due to misapplication can be cut or even eliminated.

Get more facts about STANOIL from your nearby Standard Oil lubrication specialist. There is one near you in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Quick Facts About STANOIL Industrial Oil

- **Stability**—STANOIL's antioxidant gives oil resistance to chemical change, minimizes deposits.
- **Rust Prevention**—Inhibitor in STANOIL "plates out" on metal surfaces, prevents corrosion.
- **Cold Starts**—STANOIL has low pour point. Flows freely from cold start. No need for costly warm ups.
- **Resists Effects of Temperature Change**—STANOIL has high viscosity index, is resistant to temperature change. Lubricates in both high and low temperature service.
- **Has Excellent Demulsibility**—STANOIL is refined to eliminate emulsion problems, contains additive to minimize foaming.

STANDARD OIL COMPANY
(Indiana)

STANDARD

ALLIED NEWS

Niagara Alkali Merges with Hooker Electrochemical

Stockholders of Niagara Alkali Co. and Hooker Electrochemical Co., both of Niagara Falls, N. Y., voted overwhelmingly in favor of a consolidation of the two companies. J. Clark Cassidy, formerly president of Niagara, was elected a vice president and director of Hooker at the first meeting of the consolidated board of directors.

Niagara's facilities will be operated as the Niagara Alkali Div. of Hooker. The $12,000,000 assets of Niagara will increase Hooker's total assets to over $100,000,000, and its principal product line, caustic potash and potassium carbonate, will add to Hooker's diversity of chemical manufacture.

Standard Brands Buys Clinton Foods

Assets of Clinton Foods Inc.'s corn processing division at Clinton, Iowa are to be sold to Standard Brands Inc. The proposed sale terms also include Clinton's American Partition Div., which manufactures and sells partitions for cartons and containers used in the food and brewing business.

Clinton will continue to operate as a separate division, with no changes in personnel. It is expected that the merger, in bringing together two companies in related fields, will offer opportunity for growth and expansion of both.

Allied News Briefs . . .

Babcock & Wilcox Co. has appointed Cameron & Barkley Co. of Charleston, S. C., as authorized distributor for B&W welded and seamless stainless steel tubing and pipe.

Herbert B. Addington & Associates, successors to Myers & Addington, consultants on steam and power, have announced the removal of their offices from New York, N. Y., to Pleasantville.

Becco Chemical Div., Food Machinery & Chemical Corp., Buffalo, N. Y., has patented a method for making hydrogen peroxide solutions in the concentration range between 90 and virtually 100 per cent H_2O_2 content.

Morris Machine Works, Baldwinsville, N.Y. manufacturer of heavy-duty centrifugal pumps, has announced two changes in sales territories. The central Pennsylvania area, formerly served by the late Walter L. Potter, is now handled by Ramsay Pump & Supply Co. of Pittsburgh. The new Morris representative in southeast Pennsylvania is Maleson Co. of Philadelphia.

Allied Personalities . . .

Nopco Chemical Co. has announced the appointment of **Dr. Charles A. Fletscher** as director of its industrial general laboratory. The Harrison, N. J. company has also appointed **Alfred M. Hartley Jr.** technical sales manager of the Paper Chemicals Div. Nopco recently named **Walter B. Morehouse,** former manager of the Paper Chemicals Div., to the position of vice president in charge of industrial sales.

A. M. Hartley Jr.

Keith Scott

E. N. Glauner Sr.

E. N. Glauner Jr.

Keith Scott has joined the engineering staff of Black-Clawson (Canada) Ltd. with 10 years experience in paper machine engineering. In other Black-Clawson appointments, a father-son team, **Emerson N. Glauner Sr.** and **Emerson N. Glauner Jr.,** has joined the sales staff. Both are cylinder board machine specialists. **Mr. Glauner Sr.** and **L. P. Ellison,** sales engineer representing the Shartle Div. of Black-Clawson, will operate out of the company's new eastern sales office in Downingtown, Pa.

Gerritt Hilbrand de Reus has been named to the research staff of John W. Bolton & Sons Inc. He was formerly with Lamb-Grays Harbor Co. of Hoquiam, Wash.

J. B. Laramy

A. F. Welsh

Worthington Corp., Harrison, N. J., has announced the appointment of **John B. Laramy** as assistant general sales manager and **Alvin F. Welsh** as manager of the marketing research department.

The S. Morgan Smith Co., York, Pa., has split its Northeastern Valve Div. sales territory formerly handled by the late **Maxfield Pease. Maurice H. MacDonald,** Middle Atlantic district manager, will assume charge of the area from Boston to Pittsburgh, and Chicago District manager **J. Harold Whisler** will take the western part including Cleveland, Detroit, Cincinnati and Indianapolis. **George A. Baer** will assist Mr. Whisler. The company has also announced the appointment of **Moody-Price Inc.,** Baton Rouge, La., as representative for its Valve Div. in the Louisiana-Southern Mississippi territory.

Monsanto Chemical Co. has announced two promotions in its Plastics Div. sales department. **Edmond S. Bauer** will be assistant director of sales for resin products and **Thomas W. Sears** will be sales manager for industrial resins.

Richard C. Bierck has been made general sales manager of Dean Bros. Pumps Inc., Indianapolis. Realigning the sales department, Mr. Bierck has named the following as district sales managers: **Keith G. Huizenga, Miles Sheffel, J. Robert Krebs** and **John L. Ryan.**

R. C. Bierck

M. L. Cushing

Dr. Merchant L. Cushing has been placed in charge of A. E. Staley Mfg. Co.'s paper mill laboratory of the technical service department.

This is BLACK-CLAWSON

New Vacuum Pick-Up on Newsprint Machine

The predicted heavy increase in global newsprint production during the next ten years makes newsprint machine development extremely important.

Black-Clawson's Paper Machine division builds high-speed newsprint machines and components.

The new 290" Bagley-Sewall machine at United Paper Mills, Ltd., Finland, features this Vacuum Pick-Up Press Section and a Permanent Cantilever Fourdrinier. It is completely hydraulically controlled.

The BLACK-CLAWSON *Company*

PAPER MACHINE DIVISION • WATERTOWN, NEW YORK

MISS METRONOME-1914

Quiet, competent Barbara Grieshaber was a girl too busy at home for many social larks. But she did find time to practice the piano faithfully. And, though Barbara plays no longer, for 25 years that finger dexterity has served her well in the quickening tempo of felt production. Her work is splicing—the delicate hand-weaving operation that turns Appleton felts into perfect endless belts.

Barbara Grieshaber is representative of the careful, experienced workers at the Appleton Woolen Mills . . . a 73-year-old organization dedicated to development, progress, and the production of ever finer felts—for the finest paper-making.

APPLETON WOOLEN MILLS

APPLETON, WISCONSIN

NAMES *in the* NEWS

New Research Manager at Rayonier

Dr. Ben T. Briggs has been appointed research manager of the Olympic Research Div. of Rayonier Inc., Shelton, Wash. He joined the company in 1938 as a research chemist, and has held several positions, the latest of which was research supervisor. Dr. Briggs is especially noted at Rayonier for his work on the processing of cellulose from wood.

Rayonier operates two research centers: one at Shelton and the laboratory of Alaska Pine & Cellulose Ltd. at Vancouver. A third will be completed at Whippany, N. J., in 1956.

Levandoski Becomes Head of John Strange

J. H. Levandoski, formerly executive vice president and secretary of John Strange Paper Co., has been elected president of the Menasha, Wis. company. He will succeed John G. Strange, who resigned as president and director to devote full time to his work as president of the Institute of Paper Chemistry at Appleton.

The board of directors created a new office, chairman of the board, and selected H. L. Gidwitz for the position. J. M. Levin was named vice president and secretary, and Harrison A. Smith will continue as treasurer of the company.

Eastman Research Head Retires

Dr. C.E. Kenneth Mees, for 44 years Eastman Kodak Co.'s research guide, has retired as vice president in charge of research.

Dr. Mees is one of the pioneers of American industrial research and is known the world over for his work in photographic science and as an authority on complex color photography processes. He came to this country from England in 1912 when George Eastman, Kodak founder, asked him to organize and direct a research laboratory at the Kodak Park Works in Rochester, N. Y.

In 1927 the department he had organized became the Kodak Research Laboratories to embrace all work under his direction here and abroad. Dr. Mees was made a director of the company in 1923 and vice president in charge of research and development in 1934.

Succeeding Dr. Mees will be Dr. Cyril J. Staud, who has been director of the laboratories since 1947. Dr. Staud has been in industrial research for over 30 years and is known in scientific circles especially for his managerial skill in organizing and inspiring effective teamwork toward research achievements. He holds B.S. and M.S. degrees from the University of Rochester and in 1924 obtained his Ph. D. in organic chemistry at MIT.

Spruce Falls Elects New Vice President

F.S. Seaborne has been elected executive vice president of Spruce Falls Power & Paper Co. Ltd. Mr. Seaborne has been associated with Kimberly-Clark Corp. since 1923 and will continue in his present capacity of director and vice president in charge of manufacturing of that company.

Crown Zellerbach Personnel Shifts

R. R. Edwards, formerly vice president in charge of manufacturing for Crown Zellerbach Corp. in Canada, has been made manager of bag and paper production with headquarters in San Francisco. He has been with the company since 1947. Succeeding Mr. Edwards in Vancouver will be R.J. Schadt, who had been resident manager at St. Helens, Ore. Mr. Schadt joined the company in 1923 and has served as mill manager in Port Angeles, Wash. and Carthage, N.Y.

Filling Mr. Schadt's position at St. Helens will be R.A. Dupuis, formerly assistant mill manager at Camas, Wash. J.M. Miller, plant engineer at Camas, becomes manager of engineering and assumes greater responsibilities at that location.

Frank Hamilton has been promoted to plant superintendent of the Harvey Container Div. of Robert Gair Co. Inc. Prior to this appointment he was foreman of the corrugating, printing and finishing departments.

Frank Hamilton

George Brebner

George B. Brebner was recently named plant manager of the new Chicago factory of Wabash Fibre Box Co., scheduled to go into operation in January. Mr. Brebner was sales service manager of the company's Terre Haute plant.

Charles E. Allen was recently appointed director of public relations for Crown Zellerbach Corp., succeeding William Welsh, who retired. Mr. Allen was formerly assistant director.

Robert Rothstein, former assistant sales manager of Reinhold-Gould Inc., has been named manager of the newly organized Board Div. of Aldine Paper Co.

Bonded Fibers Inc. has announced the election of three new officers: **Edward H. Tutun,** executive vice president in charge of plant operations; **Bernard Bailey,** vice president in charge of production; and **Henry Olson,** vice president in charge of technical research development.

Gardner H. Chidester, chief of the Division of Pulp and Paper at the U.S. Forest Products Laboratory in Madison, Wis., recently spent a

month in Surinam (formerly Dutch Guiana), South America, under the auspices of the International Cooperation Administration. Mr. Chidester, an internationally known expert in the field, made a study of the suitability of various tropical woods for the making of pulp and paper.

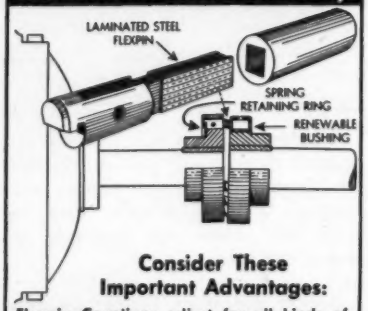
Richard W. Maley has taken over the position of assistant general superintendent of Chemical Paper Mfg. Co. He was previously with S.D. Warren Co.

Richard Maley

J. Gilbert D'Aoust

J. Gilbert D'Aoust is the new plant engineer of Powell River Co. Ltd.'s pulp and paper mill. Mr. D'Aoust was formerly chief project engineer on Powell's latest expansion program.

STOP BEARING FAILURES ...shaft misalignments the FLEXPIN COUPLING Way



Consider These Important Advantages:

Flexpin Couplings adjust for all kinds of shaft misalignments in all directions.
Act as safety device; prevent motor and machinery damage.
Expect and get 8 years and more service life from Flexpins.
Maintenance without moving connected shafts. No costly shut-downs.
. . . Easily mounted, aligned. Connected without special tools. Run in either direction; no backlash. Noiseless. Simple and safe. Reasonably priced; quick shipment.
Write today for Bulletin #53
(Parts for FRANCKE Couplings)

SMITH & **FLEXIBLE COUPLINGS** SERRELL INC.

205 WASHINGTON ST., NEWARK 2, N. J.

Robert W. Agler, president of General Container Corp., has been named to succeed Merlin C. Hamilton as president of Superior Paper Products Co. **E.C. Goebel,** formerly secretary-treasurer and assistant general manager of Superior, is now vice president and general manager of the company. Both companies are subsidiaries of St. Regis Paper Co.

Necrology . . .

William B. Greeley

William B. Greeley, United States chief forester from 1920 to 1928, died recently at the age of 76 in Port Gamble, Wash.

After receiving degrees at the University of California and Yale he became supervisor of Sequoia National Forest in 1906. During World War I he was chief of the forestry section of the A.E.F. in France. He left the forestry service in 1928 to become secretary-manager of the West Coast Lumbermen's Association and retired in 1945.

Mr. Greeley was one of the first rangers to work under the late Gifford Pinchot, who began systematic forestry work in this country before the turn of the century.

Harry A. Deyo

Harry A. Deyo, retired controller and assistant treasurer of Nekoosa-Edwards Paper Co., died in Wisconsin Rapids at the age of 63. Mr. Deyo joined Nekoosa in 1918 and worked in the laboratory, finishing, shipping and time office before transferring to the accounting department. He was named assistant secretary in 1934 and assistant treasurer in 1943.

He retired in 1953.

William V. Knoll

William V. Knoll, 66, vice president of Ross Midwest Fulton Corp., died in September.

Mr. Knoll had been in the pulp and paper industry for over 30 years. In 1926, he and others organized the Midwest-Fulton Machine Co., now a J. O. Ross Engineering subsidiary.

Wilmot Otis Roe

Wilmot Otis Roe, assistant to the president of the Dixie Cup Co., Easton, Pa., died in Easton last month.

Mr. Roe came to Dixie as a chemist 30 years ago and had worked in Easton, Darlington, S. Car., and Chicago. He was assistant to the vice president in Chicago from 1943 to 1945 and production manager at Easton from then until his appointment to the post of assistant to the president in 1949.

Louis J. Meunier, retired president of the Eagle Paper Mills Inc. of Downingtown, Pa., died recently. His age at death was 68.

Lincoln Kilbourne, 44, general manager of sales for the Industrial Div. of the Jeffrey Mfg. Co., Columbus, Ohio, died recently following a heart attack suffered at work two days earlier. Mr. Kilbourne had almost 22 years of service with the firm.

Francis Ten Eyck Sisson Sr., retired general manager and secretary of Racquette River Paper Co. of Potsdam, N. Y., died recently following a year's illness. He was 87.

Daniel L. Quirk, 85, former president of Peninsular Paper Co. at Ypsilanti, Mich., died in October.

John Allison Dodd, president of Davey Co., Jersey City, N.J., passed away after an operation at the age of 59. Mr. Dodd was on the board of directors of Fairlie & Wilson Co., Newark, and on the advisory board of the Bloomfield branch of Nation Newark & Essex Banking Co.

Frank A. Kleiler, 71, died recently in Milwaukee. Mr. Kleiler served for many years as chief plant engineer of Cornell Paperboard Products Co.'s Milwaukee plant and had retired in January, 1955.

David A. Fleischman, consultant engineer for St. Regis Paper Co., died in his South Pasadena home at 68. He had been with St. Regis for 44 years and was Pacific Coast manager from 1930 to 1940.

Arthur Havemeyer, former president of Package Paper Co. of Holyoke, Mass., died in Boston at the age of 73.

William J. Murphy, vice president in charge of sales and a director of American Potash & Chemical Corp., died of a heart attack last month in Glen Ridge, N. J. He was 60.

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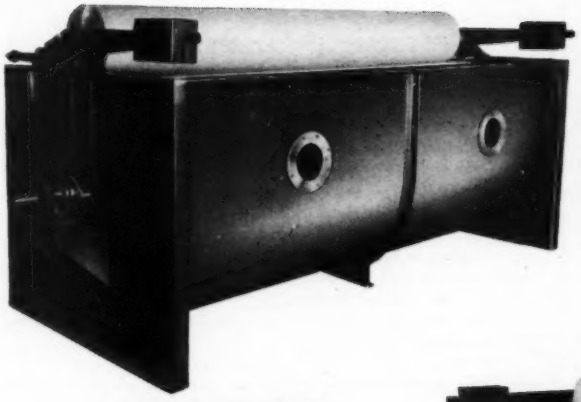
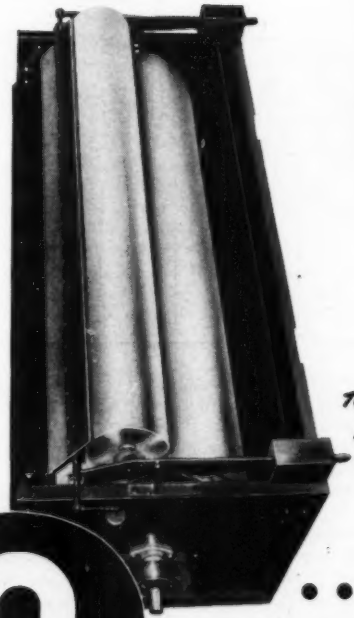


VIEW OF END AND INTAKE SIDE OF COWAN DECKER

VIEW OF EFFLUENT DISCHARGE END FROM INTAKE SIDE



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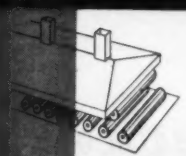

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PATENT REVIEWS

MELVIN NORD*

Manufacture of Wood Pulp

U.S. 2,701,763, issued Feb. 8, 1955, to George Sivola (Tainionkoski, Finland), describes a new process of manufacturing pulp by using a three-phase acid-alkali cooking operation which is claimed to produce a pulp which is as white as ordinary calcium base sulfite pulp, which has low pitch content and is easily bleached.

The first phase of cooking is conducted with acid liquor to produce incompletely digested pulp. In the second phase the acid cooking liquor is converted to alkali liquor by injecting alkali into the digester. The third phase is conducted with alkali liquor to complete the digesting of pulp. The three phases have self-supporting cyclic systems for the recovery of chemicals and heat. With this process, it is possible to produce pulp of high purity and of high alpha content of the order of 96 or 98 per cent or higher, which can be used for the manufacture of cellulose derivatives. In contrast therewith, the conventional sulfite or alkali processes can only produce low purity and low alpha pulps of the order of 88 to 91 per cent.

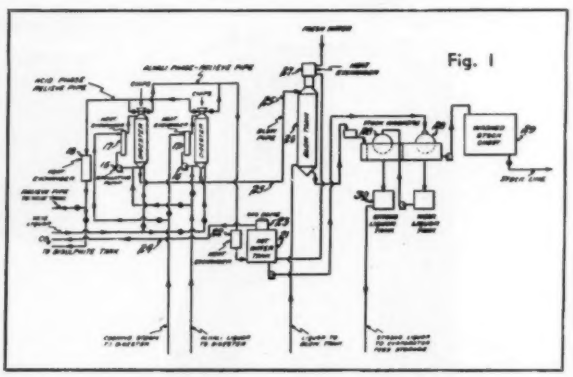


Fig. 1

The process is shown in Figs. 1-3, Fig. 1 being a flowsheet of the over-all process, Fig. 2 a flowsheet of the acid operations, and Fig. 3 a flowsheet of the alkali operations.

Sulfurous acid is made by burning sulfur to SO_2 in an acid burner 10 (Fig. 2). The SO_2 gas is cooled in an SO_2 cooler 11 and after that is blown by an SO_2 fan into an absorption tower 13, where it is taken up by water and sodium bi-sulfite pumped from the bi-sulfite tanks 14. Bi-sulfite is made in batches and pumped to the top of the absorption tower. From the absorption tower, the acid is pumped or runs by gravity into the acid tanks 15. To strengthen the cooking acid, So_2 gas vented from the digesters during the acid cooking phase is blown into the last acid tank.

When the digester is filled with chips, acid is pumped into the digester (Fig. 1). The valves are closed and the circulating pump 16 is started. The steam is turned on to the heat exchanger 17. When the pressure has risen to the chosen maximum limit the gases are relieved and cooled in heat exchangers 18, then at the beginning of the cook blown into the acid tank 15. After that, during the acid phase, the SO_2 is blown either into the bisulfite tanks or into the acid tank 15.

When the injection of alkali takes place, the alkali is pumped with injection pump 18 (Fig. 3) from the alkali tank 19 into the suction side of the circulating pump 16. During the alkali phase of the cooking the digester is relieved into the hot water tank 21 through a heat exchanger 22. On top of the hot water tank is a dome 23 to collect gases. From the dome there is a pipeline to the blow tank is a heat exchanger 27 in which the steam vapors relieved during the blow are condensed and the condensate goes

*Patent attorney, 17600 Pinehurst, Detroit 21.

to the hot water tank. From the blow tank, the pulp is pumped to stock washers 28 where the liquor is separated from the fibers. From the washers, the pulp is pumped to the washed stock chest 29. From the strong liquor tank 30, the waste cooking liquor goes into the evaporation feed storage 31 (Fig. 3). From that tank, some liquor is pumped into the blow tank to dilute the stock. The rest of the liquor goes into the evaporators 32 where it is evaporated to 50-60 per cent total solid contents. From there, it goes into the liquor storage 33, and then to the cascade evaporators 34, where the liquor is evaporated to a solid content of 60-70 per cent. This is done by putting flue gases through the cascade evaporators. From these evaporators, the thick liquor goes into the recovery boiler,

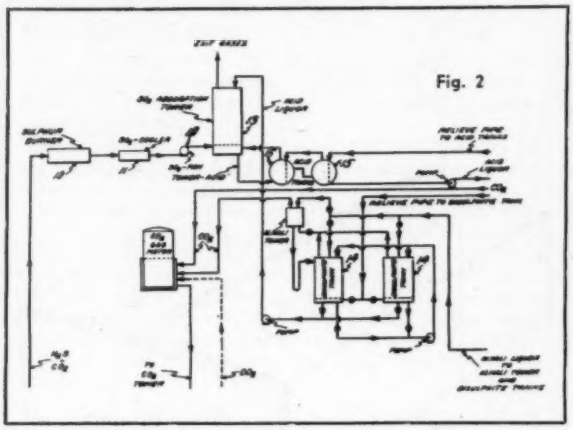


Fig. 2

where it is burned for the recovery of heat and chemicals. The flue gases after leaving the cascade evaporators go into an electrical gas filter where alkali and sulfur are recovered. The recovered chemicals are returned to the system where the salt cake is added. Finally, the gases go into the stack. If salt cake is used to compensate the alkali losses, it is added into the liquor before it is fed into the boiler. From the boiler, the smelt, mainly sodium carbonate and sodium sulfide, runs into the dissolving tank 35 where it is dissolved with the filtrate from the bicarbonate separator 36 or water. From there, the dissolved liquor goes into a

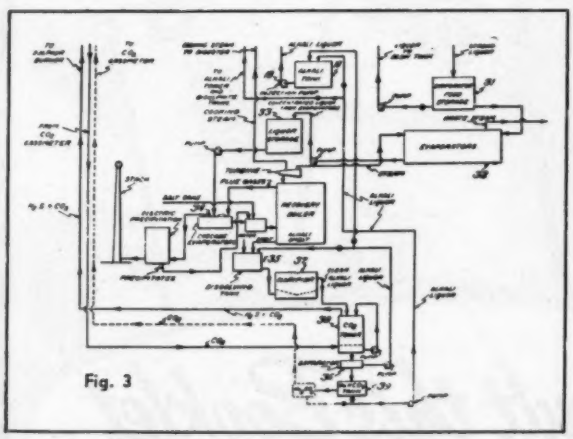
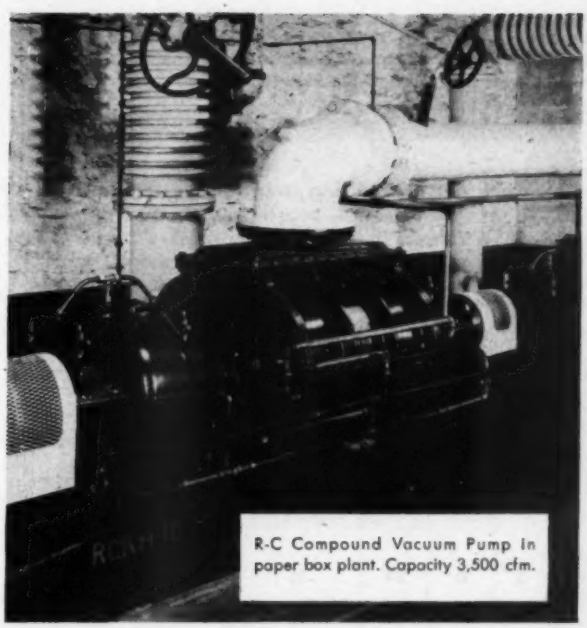


Fig. 3

clarifier 37 and then into a CO_2 tower 38. In this tower, sodium carbonate is converted to sodium bicarbonate and the sodium sulfide to sodium carbonate and hydrogen sulfide (H_2S). The liberated H_2S is burned to SO_2 in the sulfur burner. The sodium bi-carbonate crystals formed by treating the clarified liquor with the CO_2 are separated, and the filtrate is used either as a dissolving water in the dissolving tank or as injection alkali. This filtrate contains some sodium sulfide but does not do any harm in the cooking process, as there is no free sulfur formed due to the alkaline condition in the digester. From the separator, sodium bicarbonate goes into the bicarbonate tank 39. If salt cake is used to cover the sodium losses and if for some purpose soda ash is



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needed, for instance, for bleaching, soda ash can be readily made by driving off the CO_2 from the sodium bicarbonate. When sodium hydrate or sodium carbonate or sodium bicarbonate is used to make up sodium losses, they are added either into the bi-sulfite tanks or into the alkali tank.

The patent describes the conditions of operation in detail.

Compartmented Folding Box

U.S. 2,700,499, issued Jan. 25, 1955, to Yves Durand (Arques, France), describes a number of compartmented folding boxes which can each be made from a single cardboard sheet.

Figs. 4, 5 and 6 show a six-compartment box in various stages. The rectangular sheet has a length-to-width ratio of 8:5. Four linear cuts, a, b, c, and d parallel to the longer sides and folding element of the box. The method of folding the various elements is shown in Figs. 5 and 6.

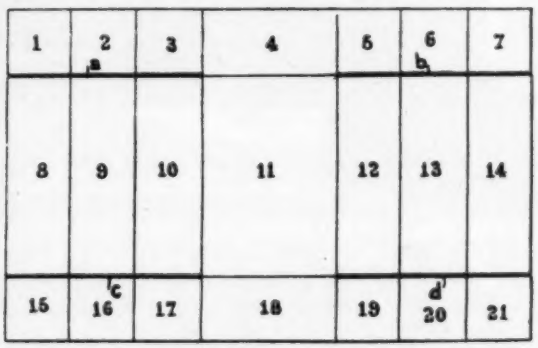
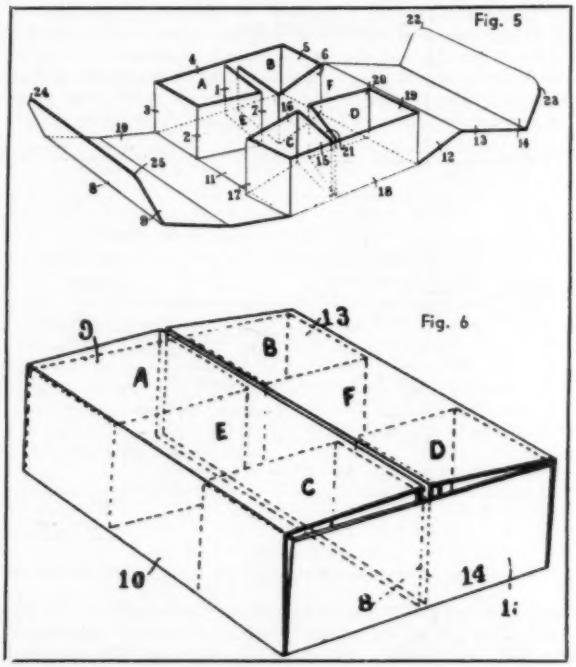


Fig. 4

Patent Reviews . . .



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Conditioning Papermaking Stock

U.S. 2,217,536, issued Sept. 13, 1955, to Carlelton L. Clark et al and assigned to the Rotaread Corp., provides an apparatus to improve the handleability of papermaking stock by deaerating it, and also to clean or de-dirt the stock prior to supplying it to the papermaking machine. The two steps are accomplished in conjunction with each other by passing the stock to the deaerator through hydrocyclones instead of spray nozzles, so that only one set of feed pressures is used instead of two, and yet the stock sprayed into the deaerating receiver has already been cleaned.

Process for Improving Water-Absorbency of Paper

U.S. 2,712,994, issued July 12, 1955, to George E. Niles and assigned to Monsanto Chemical Corp., describes a process for improving the rewetting properties or water-absorbency of paper for use as paper towelling.

As an example of the method, a wood pulp finish of 35 per cent bleached sulfite pulp and 65 per cent bleached soda pulp was beaten to 500cc. TAPPI freeness. To this was added 0.2 per cent, based on the dry pulp weight, of the reaction product of 100 parts of tall oil and 140 parts of ethylene oxide. This pulp slush was divided into two equal parts, one containing 1 per cent alum and the other containing no alum. The samples were then made into paper on a Noble-Wood laboratory sheet machine and had a basis weight of 43 lb. per ream. The dried paper was tested for absorbency. The number of seconds for the paper to absorb completely 0.5 cc. of water was determined. The results were as follows:

	No Alum	1% Alum
Blank	11 secs.	13 secs
Treated paper	7 secs.	9 secs.

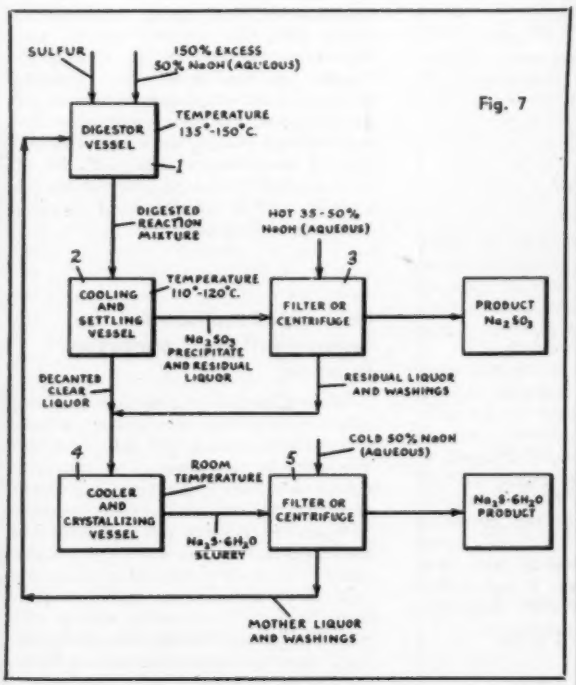

Fig. 7

Manufacture of Sodium Sulfide and Sulfite

U.S. 2,705,187, issued March 29, 1955, to George N. Terziev and assigned to Allied Chemical & Dye Corp., describes a process for the manufacture of sodium sulfide and sodium sulfite by reacting sulfur with an aqueous sodium hydroxide solution at the boiling point of the mixture:

$$6NaOH + 3S \longrightarrow 2Na_2S + Na_2SO_3 + 3H_2O$$

The flowsheet, Fig. 7, shows the method used.

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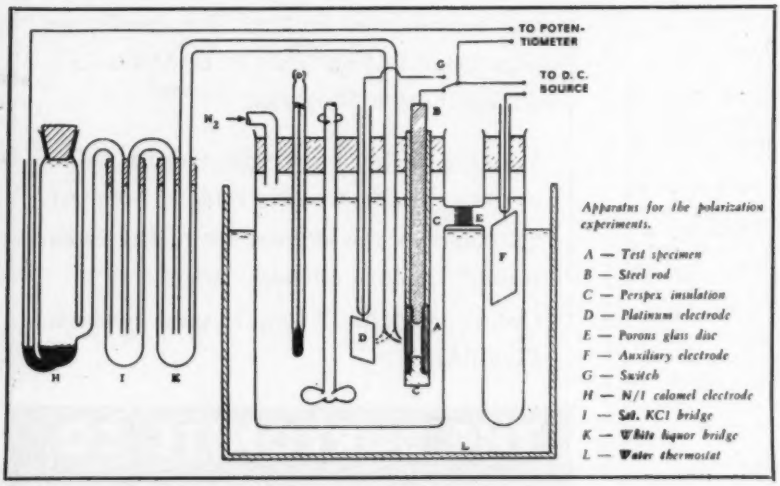

Apparatus for the polarization experiments.

A — Test specimen
B — Steel rod
C — Perspex insulation
D — Platinum electrode
E — Porous glass disc
F — Auxiliary electrode
G — Switch
H — N/1 calomel electrode
I — Sat. KCl bridge
K — White liquor bridge
L — Water thermostat

The corrosion of steel in white liquor

This is a communication from the Norwegian Sulfate Corrosion Committee. Corrosion was studied by means of polarization experiments, using the apparatus shown in the figure, and also by the determination of losses in weight. Steel corrosion is caused by the sodium polysulfides in the liquor and involves the formation of ferrous ions which are precipitated as ferrous sulfide, while an equivalent amount of the polysulfide is reduced to sulfide ions by the excess of electrons on the corroding steel surface.

The amount of polysulfides is determined by an equilibrium between polysulfide-, sulfide-, sulfite- and thiosulfate ions, as indicated by the equation: $Na_2S_2O_3 + Na_2S = Na_2SO_3 + Na_2S_2$. The concentration of sodium hydroxide affects corrosion by determining the concentration of unhydrolyzed sodium sulfide in the liquor. Corrosion rate is determined by the rate at which polysulfide ions are transported to the steel surface. They come partly from the bulk of the solution by diffusion through the layer of ferrous sulfide and in part by the reaction between sulfide and thiosulfate within the diffusion layer.

Corrosivity of the liquor appears to be proportional to the product of the concentrations of thiosulfate and sulfide, with a suitable adjustment for the action of the caustic soda on the sodium sulfide. Corrosive action is *decreased* by *increasing* the concentration of sodium sulfite. High concentrations of polysulfides inhibit corrosion by promoting passivation of the steel; this appears to be the conservation of the oxygen-type of passivation, rather than inducing a sulfide type of passivation—with the exception of those liquors that are very high in polysulfides.

The foregoing views on corrosion are in harmony with the experimental evidence, at least qualitatively. B. Haegland and B. Roald. *Norsk Skogind.* 9 351-364 (1955). (in English).

Slime and its control in paper mills

This is a descriptive article in which microorganisms, their propagation and sources of introduction into the mill are discussed. The authors also describe methods for recognizing their presence in pulp and paper mills and their control.

Agents which serve to combat slime include such exidizing chemicals as chlorine and peroxides, organic emulsions of certain types, and chlorphenols and mercury salts. Slime formation is shown by the "Bulab" test [*Tappi* 34,302 (1951)] and also by hanging a small wooden or asbestos cement slab in the circulating mill water and gaging the slime deposit during the course of several days. Fourteen references are given. Erhard Liebert and Kurt Jagenberg *Wochbl. Papierfabr.* 83, 475-478 (1955) (in German).

Effects of sulfite spent liquor on a Swedish watercourse

In 1954-1955, a series of analyses were made on the waters of a system of lakes which served in the disposal of sulfite spent liquors from an adjacent mill at Kyrkebyns Bruk. The study showed that the liquor normally was rendered harmless as far as the fish were concerned, leaving a sufficiently high oxygen content in the watercourse. In winter, the liquor flows along the bottom of the largest lake (Vanern), and causes no harm. In the summer the liquor tends to flow up towards the surface, but is then carried off through a canal-like water way (the Trangsundet) by a surface current. Since the currents are thermoconvectional, and as there is a clean current at the bottom, clean water is supplied from Lake Vanern.

However in calm weather or when there are continuous easterly winds, the surface current may stop and stagnation may result and somewhat polluted water may be forced into the Northernmost Lake Kyrkebysjon or the Westerly Lake Ekholmsjon. This critical situation can usually be met successfully, since the oxygen input from the air is usually sufficiently high.

It is only at the site of the sulfite mill itself (at the canal-like Ransundet) that spoilage results in the local waters during the summer. However other parts of the lake region appear to be protected. Occasionally death of fishes has been reported when the weather conditions were extremely unfavorable and the spent liquor disposal has been great. Since, however, the mill now evaporates and burns its liquor in part, the spent liquor inflow has been reduced sharply and is not likely to cause a recurrence of this difficulty. F. A. Salomonson. *Svensk Paperstidn.* 58, 674-685 (1955) (Original in Swedish, with English summary).

New rapid method for the determination of pentosans in wood

After making a critical survey of the older methods for determining pentose sugars and pentosans, the author suggests the following technique. The sample is treated with 12-13 per cent hydrochloric acid, and the mixture is heated for about ¾ hours in a steam of carbon dioxide. The furfural, which appears to be freed quantitatively, is carried over and trapped in a solution of 2, 4-dinitrophenylhydrazine in hydrochloric acid containing sodium chloride. The granular orange precipitate (furfural dinitrophenylhydrazone) can be filtered after standing 1 hour at 0° C., or 3 hours at room temperature, and is washed with water, dried and weighed. A small correction is made for solubility. Otherwise, the method is claimed to be quantitative and is extremely rapid. Excellent results are claimed for both xylose and arabinose. Seventy-three references are included. K. Kürschner. *Holzforschung* 9,-129-139 (1955). (In German).

Folding endurance of eucalypt pulps

A comparison was made of the performances of the Köhler-Molin fold tester, an improved, modified M.I.T. tester and an unmodified M.I.T. tester, when applied to laboratory handsheets and to commercial papers made either wholly or in part from eucalypt pulps. Although the M.I.T. tester (in modified form) and the Köhler-Molin tester could not be compared directly, their performances were at least similar. In the case of the Köhler-Molin instrument, the load on the test strip was varied, and the results obtained were similar to those found previously with long-fibered pulps. As the strip width of the sample increased, the fold value also rose. This may be an important cause of the variation of individual tests unless the test strips are cut accurately. However there was no simple relationship between the width of the strip and the folding endurance. A. J. Watson and Valerie Goldsmith. *Australian Pulp and Paper Ind. Tech.* Assoc., Proc. 8,226-35 (1954).

Technological properties of art papers

Despite the fact that printing ink is applied exclusively to the coated layer, the paper base is extremely important in determining the suitability of a specific coated art paper for printing purposes. The influence and effects of the cellulose fibers (in chemical pulps, esparto and groundwood pulps) are discussed. The following subjects are also treated: type of beating used, sizing, sheet formation, calendering, moisture content of the base paper, and composition of the coating material on the quality of the finished coated sheet. In an ideal art paper, the difference between the breaking length in the machine direction and that in the cross-machine direction should be as small as possible. Since often many conflicting demands are placed on the art paper by various converters, compromises in paper quality must result. Plastic deformability of the paper proves to be a disadvantage in printing but is essential when the paper must also be embossed. To obtain satisfactory prints, proper conditioning, transport, storage of the paper and air-conditioning of the printing rooms are prerequisites. However the true value of the paper can only be developed fully by proper treatment by the printer himself. Erwin Lemke, *Papierwereld,* 9, No. 10, 259-63 (1955) (Original in German; through *Bull. Inst. Paper Chem.* 26, 41 (1955).

Pulping Araucaria woods in the laboratory

Two species of Araucaria, *A-klinkii* and *A-cunninghamii,* from New Guinea were studied from the standpoint of their physical, chemical and pulping properties. Samples were taken both from virgin stands and from plantations, and chemical analyses were made on representative mixed samples as well as on the wood of individual butt logs. The butt samples from *A-cunninghamii* usually gave higher lignin and lower furfural yields than did those from *A-klinkii,* but the woods were quite similar. In the composite samples, the furfural yields and the percentage holocellulose and "pure" cellulose were all somewhat higher in *A-klinkii* than in *A-cunninghamii.* In virgin stock, the tracheid length for unbeaten kraft pulps was about 5.6 millimeters. Trees from the plantations gave good yields both of kraft and sulfite pulps (ranging usually from 44 to 46 per cent). The wood from virgin stock gave variable (but very good) pulp yields depending on cooking conditions.

In all cases the kraft pulps were greatly superior to the sulfite pulps in their strength properties and the sulfate pulps compared very favorably with those made from European conifers. However the fibers from these Araucarias were damaged more easily by high pulping temperatures and by beating than are those of other coniferous woods. Even relatively gentle beating reduced the tearing strength (which is often unusually high). Hand-made chips gave much stronger pulps than those made by the use of chippers, although even the latter when beaten very lightly gave a higher tear, folding endurance and burst than did many good commercial kraft pulps. A. von Koeppen and L. Sitzman. *Australian Pulp and Paper Ind. Tech. Assoc., Proc.* 8, 264-289 (1954).

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Rapid Continuous Pulping

(Continued from page 932)

siderably higher viscosity of 1680 should indicate a superior pulp.

In comparing pulps 1700 and 1708, No. 1708 shows a marked superiority even though the pulps were cooked identically except for chip size. Pulp 1708 was made from full size chips. The tests indicate, from a strength standpoint, that shredding has a harmful effect in pulping. This is contrary to the viscosity values, higher in the case of the shredded pulp. Also, in the other batch cooks (1672 and 1680), shredded wood was slightly superior.

Turning to the rapid pulping data, the most degraded pulp (1715), according to viscosity, showed the highest strength, Pulp No. 1724, with a viscosity approaching that of the strongest of the batch pulps, No. 1708, showed the lowest over-all strength of any of the pulps tested. This particular pulp, 1715, although poorest of all in burst and tensile, showed a tear strength second only to pulp No. 1672.

The reasonable conclusion seems to be that most of the differences in physical strength are due to variances in the tests themselves. If this conclusion is correct, all of the pulps under discussion were possessed of the same physical characteristics. If this be the case, pulp viscosity in the range from 48.6 down to 27.4 c.p. does not materially change physical strength. These viscosities correspond to a degree of polymerization range of 1845 to 1517.

This constancy of physical strength with variations of viscosity in the high range of viscosities may be correct. Recently, a series of bleaching experiments was carried out here on Swedish kraft pulp. Bleaching conditions varied widely, so that the bleached pulps, which had an unbleached viscosity of 36.8 c.p., had viscosities ranging from 17.5 down to 7.9 c.p. The pulps with viscosities of 15.5 and 17.5 c.p. were only slightly inferior in over-all strength to the unbleached pulp. As viscosity after bleaching decreased to 14.0, 10.3 and 7.9, pulp strengths became successively lower.

From these considerations it would appear that viscosity and screened yield should be the best indications of efficiency of pulping.

Bibliography

1. Nolan, W. J., and Brown, W. F., High Speed Continuous Alkaline Pulping, *Pulp and Paper Mag. Can.*, 53, No. 9:98-110 (Aug. 1952)

2. Nolan, W. J., and Brown, W. F., Effect of Chip Size in Alkaline Pulping, *Tappi*, 35, No. 9 (Sept. 1952)

3. Kulkarni, G. R., and Nolan, W. J., The Mechanism of Alkaline Pulping, *Paper Ind.*, 37, No. 2 (May 1955)

NEW PRODUCTS

Phenolic tube winder

A special machine for manufacturing phenolic impregnated paper tubes was recently built and installed for a large electrical manufacturer. The tubes are part of high voltage transformers and are 100 in. long by 12- to 30-in. inside diameter.

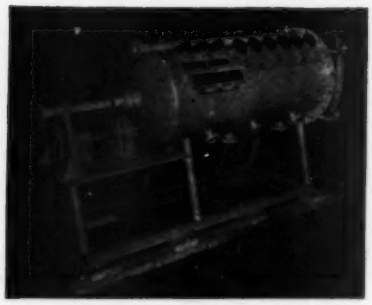
The machine line includes a single position unwind stand, a two-roll nip slitter section and a spring roll. This equipment controls both the tension and the width of the web of paper and prepares it for winding on pneumatic pressure loaded mandrel over two saddle rolls with center wind drive through the winding mandrel. *Black-Clawson Co., Dilts Machine Works Div., Fulton, N. Y.*

Board surfacing resins

Two new board surfacing resins for applying a decorative, protective plastic surface to low-cost structural boards by means of low-pressure laminating techniques will overcome chief disadvantages of previous commercial surfacing methods. It is claimed that boards finished with the new resins approach those of standard decorative melamine laminates.

Standard decorative print stock and overlay paper are treated on conventional equipment. The treated papers are completely dry and non-blocking and may easily be laminated to the surface of hardboards such as Masonite or low-density particle boards such as woodwaste or chipboard. A satisfactory curing cycle is 10 min. at 250 psi., 300° F. No adhesive or balance sheets are necessary.

The same technique is also suitable for a new process — the finishing of fancy wood veneer-faced lumber core or plywood assembly by surfacing with a single resin-treated transparent overlay sheet. The entire assembly, including cross-banding plies, may be bonded and cured in a single low-pressure operation in conventional laminating or plywood presses. *American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N.Y.*



Pressure leaf filter

A self-cleaning pressure leaf filter has been developed which is capable of filtering 12,000 gph.

This filter is equipped with sight ports through which the individual filter leaves can be inspected. These ports can be dogged down quickly for the operation of the filter. *Hercules Filter Corp., Hawthorne, N. J.*

Moisture register refinements

New refinements in electronic components and techniques of moisture measurement of "paper" materials have been announced. The manufacturer indicates that technical advances, which incorporate the latest in miniature electronic tubes, permit sensitive moisture indication in a variety of substances not measureable heretofore by the quick electronic means. Among these materials are cellophanes and many of the newer sheet plastics, polyethylene bags, hard board, new types of asbestos-cement siding and roofing insulating materials, gypsum board, sheet rock, multi-wall bags of various types, and other materials in which moisture is an important factor.

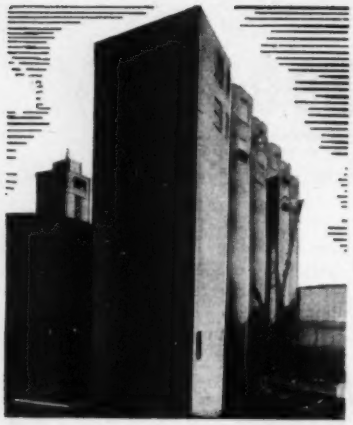
The manufacturer emphasizes that these new instruments are light in weight, completely portable, and may thus be used at many places on a production line as the need arises. It is claimed that they are particularly useful in spot-checking moisture content and do not mar the sample. It is further pointed out that each test made to indicate percentage of moisture content takes only three seconds and may be made by non-technical production personnel. To insure the manufacturer's guarantee of accuracy within close tolerances, each instrument is specially calibrated at the factory against user's samples.

Each of the two models now available operates on a patented principle of high-frequency power absorption, permitting, according to claims made, measurements to both higher and lower moisture ranges than instruments using conventional principles. One of the models, equipped with spring-loaded button electrodes for measuring irregular or curved surfaces, has a claimed electronic penetration of 1 in. and is designed for testing rolls or stacks of paper or paperboard. A second model has a large electrode for use on individual thicknesses or thin stacks, with a penetration of ⅛ in. *Moisture Register Co., P. O. Box 910, Alhambra, Calif.*

Starch products

Development of two new starch products designed to meet a growing demand for higher production speed in the corrugating industry was announced at the Fifth Annual Corrugated Containers Conference of the Technical Association of Pulp and Paper Industry (Tappi) in Chicago.

The manufacturer states that the new products, Bondcor S and Bondcor D, have been developed as converted corn starches for the dual viscosity paste system, which



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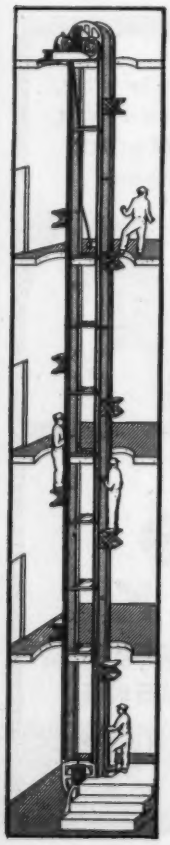

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it appears is growing in popularity throughout the industry. The claim is made that the new products offer numerous advantages over ordinary corn starch, including a substantial cost-savings potential.

It is stated that Bondcor S develops a thinner viscosity paste during its gelatinization, resulting in a deeper penetrating adhesive bond, with firm anchorage at the single facer, thus providing faster tack than regular corn starch. It appears that this property makes it a faster bonding agent at the modern high-speed single facers, or on heat-deficient machines and those running heavy weight liners. It is pointed out that thinner viscosity during the gelatinization period allows for better adhesive migration, particularly when used with short-fibred, semichemical grades of corrugating medium. Under normal operating conditions of pumping and agitation, it is claimed that Bondcor S will maintain a more stable viscosity than straight corn starch.

Bondcor D, a thick-boiling, heavy-bodied converted cornstarch, is designed especially for heavier viscosity during gelatinization than straight pearl corn starch. It tends to prevent excessive paste migration or penetration at the double backer, and to reduce loss of glue line and bond, or poor bond. It is claimed that the product's higher viscosity and heavier body reduce production of soft board and help maintain higher machine speeds; also, that it prevents loose-back on wet, wet-streaked or heavy-weight liners, and that it is economical to use. It appears that, through the use of Bondcor D, it is possible to cut the amount of glue applied and save the glue usually lost in penetration of medium and liner. Closer-to-surface bonding can be obtained at the double backer with Bondcor D, it is claimed, than with regular corn starch. *Stein, Hall & Co. Inc., 285 Madison Ave., New York 17, N. Y.*

New Products . . . . . .

Sizing agent

An alkylketene dimer, a new sizing agent recently developed under the trade name Aquapel, has been successfully used in a large number of mill trials during the year.

According to the manufacturer, its effective use as a sizing agent stems from the fact that it reacts with the cellulose fibers of the paper to form strong, chemical bonds, resulting in a very hard and permanent type of sizing, or resistance to water penetration. It can be applied at the size press, size tub, calender box, coater, and by spray application.

It is claimed that paper sized with Aquapel presents no problem in handling broke, which can be defibered in the same way as any other hard-sized paper. Paper sized with this product shows a high degree of resistance to lactic acid solutions, alkaline solutions, and other aqueous penetrants. *Hercules Powder Co., Dept. PI, Wilmington 99, Del.*

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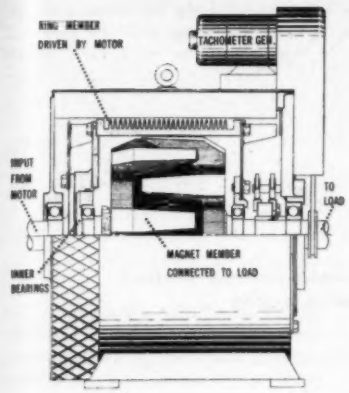

Speed drive

A new precise adjustable speed drive, which is said to be easy to handle, install, and operate, may be used as a general purpose drive. This unit, known as the Ampli-Speed, can be coupled or belted to an existing motor to provide a speed control of ± 2 per cent for fans, centrifugal pumps and compressors. It is also designed to handle constant torque loads such as mills, conveyors, machine tools and a great many other applications.

According to the manufacturer, the user can operate a load at the optimum speed, change speed smoothly by means of a knob, or control it automatically; use the drive for test and development work; control output of fans, pumps and compressors automatically with precision; increase efficiency of fan and pump drives; decrease wear of moving parts, and eliminate shocks between the motor and load.

This drive is air cooled and requires no external cooling system, and is handled like a motor. The Ampli-Speed drive is designed for use with motor speeds of 870, 1150, or 1750 rpm. Horsepower ratings of the two sizes range up to 95 hp for fan-type loads. For constant torque loads, the output ranges up to 75 hp, depending upon input speed and required speed range. *Electric Machinery Mfg. Co., Minneapolis 13, Minn.*

PVC fittings and flexible tubing

The introduction of a new line of instrumentation fittings made of unplasticized polyvinyl chloride and, for use with them, corrosion resistant flexible tubing has been announced.

The new PVC fittings will hold burst pressures in excess of those to which the flexible tubing may be subjected, and they cannot be overtightened by hand. The tubing itself is practically inert and, according to the manufacturer, is not affected by most acids and alkalies. It is extremely tough and durable, yet flexible enough, even at low temperatures, for easy handling and working. It is odorless, tasteless and non-toxic. The connections and tubing are unaffected by vibration and severe movement.

The fittings and tubing are furnished in both ¼- and 3/8-in. sizes. Maximum

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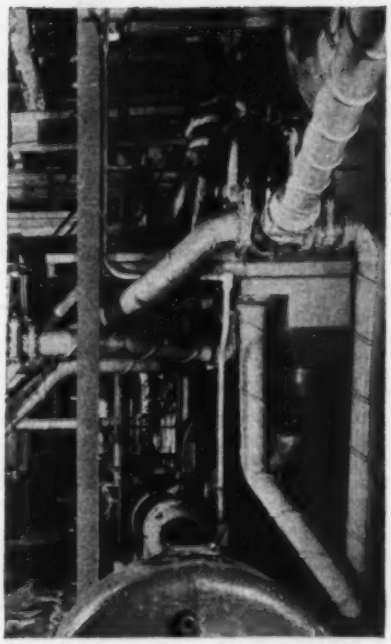

To meet your piping requirements, Naylor offers a fabrication service that can save time, labor and money —no matter how complicated the layout. This one-source service combines Naylor Spiralweld pipe with standard fittings or special fabrications in one integral unit, thus eliminating numerous flanged joints and cutting costs substantially. Naylor pipe sizes range in diameter from 4" to 30" with all types of fittings and connections. Both pipe and fittings are available in steel, alloys and stainless steel.

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CORPORATION BRIEFS

• Edited by GEORGE BLACK

ENGINEERING DATA BOOK

Another section of the new Cooper Alloy catalog being readied by the Valve and Fitting Division is now available. Referred to as "Stainless Steel Engineering Data," this 16 page manual includes a variety of tables and charts of reference value for those who work with stainless steel valves, fittings, pipe, tubing or castings. Your copy is waiting.

ADVANCED KNOW-HOW #1

The full story behind the Shellcast® stainless steel jet engine support rings being turned out by the Foundry Products Division of Cooper Alloy is told in Advanced Know-How Report #1. The problem, the specifications and the solution are covered in detail with text and photos. Write for your copy.

PUMPING ETCH ROOM SOLUTIONS

Transferring acids and salt solutions used in the Etch Room of Litho Chemical & Supply Co. caused repeated pump failure and constant shaft seal maintenance. Five years ago a Vanton plastic pump (no stuffing box, no shaft seals) was put into daily service. Customer reports "no maintenance except lubrication." Full story appeared in Chemical Processing (July). Reprint available on request.

QUIKUPL DATA POPULAR

Since the publication of the May issue of Newscast which featured this patented fitting, the requests for additional data have been pouring in. In case you missed the issue, may we remind you that copies are still available. Full engineering data, case histories and photographs are included, making it possible for you to see for yourself just how this unique stainless steel fitting can cut your installation and operating costs.

COOPER ALLOY
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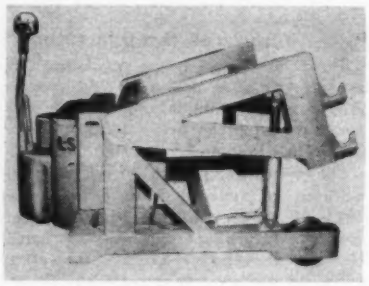
New Products . . . . . .

working pressure is 150 psi at 75°F. Designed for long service life, these new products permit an entire assembly to be put together by hand with a knife or scissors to cut the tubing to the proper length. Labor costs are therefore cut, and a possible substantial savings is realized. *Tube Turns Plastics, Inc., 224 E. Broadway, Dept. PI, Louisville 1, Ky.*



Electric cable reel truck

A new "Walkie" electric truck, designed for handling cable reels weighing up to 10,000 lb. (also available in capacities to 20,000 lb.) is now being manufactured. The truck can handle the full range of diameters from 36 to 90 in. with no manual adjustment of the lifting hooks. Maximum reel width is 68 in.

Twin hydraulic cylinders are synchronized to lift together. Lifting and lowering controls, brake, traction, direction and horn are located in the handle head.

For easy maneuverability, the truck operates with the handle in any position, including vertical. Storage battery power gives an ideal, controlled walking speed, whether the truck is empty or loaded. *Lewis-Shepard Products, Inc., Dept. R-25, Watertown, Mass.*

Powder-spray attachment

A new powder-spray attachment for bag-making machines and flexographic presses has been manufactured and is now being marketed which prevents polyethylene surfaces from sticking together and gives it the "slip" needed in the making of bags and wraps.

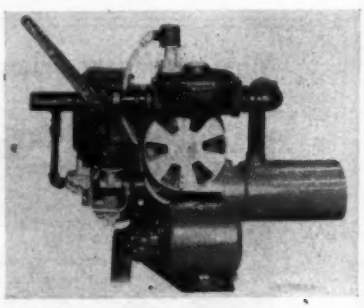
Easily installed on any polyethylene bag-making machine and printing press, the new unit sprays special powder onto the polyethylene through three, six or nine adjustable nozzles providing either partial or full area coverage. All nozzles are independent of each other so each nozzle can be placed where it is needed. Each nozzle has its own cutoff valve to compensate for wide and narrow stock, and can be set to spray in any direction up, down or sideways. The unit, which has no moving parts, requires only two to twelve lb. of air for either continuous or intermittent operation.

Abrasive-free and non-toxic free flowing, this powder is quickly adapted to any type equipment running any type film that has a tendency to be sticky and needs added slip. Other film converting problems solved with this attachment include elimination of offset and smear in flexographic printing, and preventing the stickiness of glassine overvarnish during rewind. *H & H Products, 1930 S. State St., Chicago 16, Ill.*

Crypto-anionic surface active agent

A new surfactant which, it is claimed, combines the advantages of anionic soap and non-ionic detergents, while inheriting none of their disadvantages, has been announced.

Called Sandopan DTC, the surfactant is said to be chemically different from any soap, detergent or wetting agent on the market. Available in either gel or liquid form, the outstanding ability of Sandopan DTC appears to be its ability to keep solid matter in suspension, prevent redeposition and allow for complete removal, all of which would seem to make for greatly improved deinking and higher brightness ratings. In addition, the new agent possesses extreme wetting and penetrating properties, plus strong detergent action and easy rinsibility, which qualify it, the manufacturer claims, as a highly effective felt-washing compound. *Sandoz Chemical Works Inc., 61-63 Van Dam St., New York 13, N. Y.*



Gas burners

A new low-cost gas burner with easily set accurate air-gas ratios, and high-quality controls, according to the manufacturer, is now on the market. Available are six new gas and gas/oil burners with capacities ranging from 720,000 to 8,600,000 btu. Newly introduced models can be used for gas alone, for light oil (No. 2 grade) and gas, and a combination of heavy oil (No. 5 grade) and gas.

All secondary air in these burners is furnished by the burner, thus it does not have to depend on stack draft. Air is metered in the right quantity to provide correct air to fuel ratios for efficient combustion, it is claimed.

The manufacturer states that oil and gas interchange is accomplished instantaneously by the flip of a switch. Air is controlled through the damper modulating between high and low fire. *Cleaver-Brooks Co., Burner Div., 326 E. Keefe Ave., Milwaukee 12, Wis.*

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2 — Black-Clawson Wet Lap Machines, one 72 " and one 96". Completely reworked and like new.

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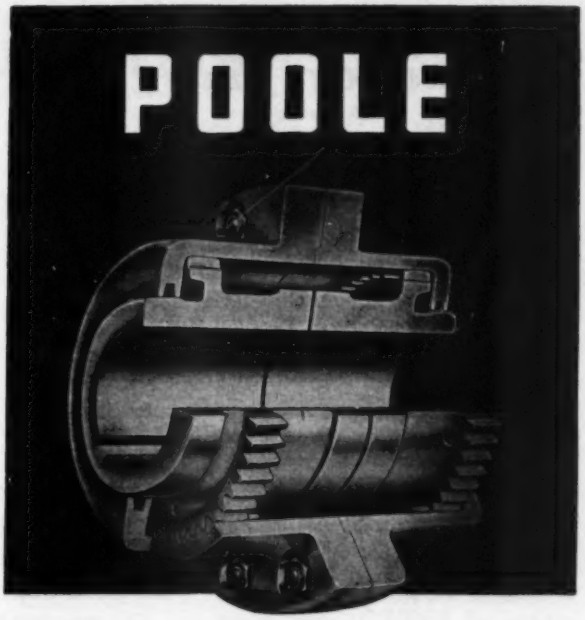

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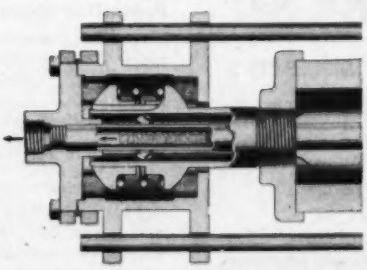
The Type LJ Johnson Joint has lugs cast right on the body to accommodate supporting rods. This design lifts the weight of the body from the rotating assembly—permits it to "float" freely inside. Joint shown at left is for syphon pipe service, has steam inlet in side of body 90° from lugs. Type LJ is also available for thru flow service.



Write for complete information. Johnson Joints are also furnished in pipe-supported and self-supported types.

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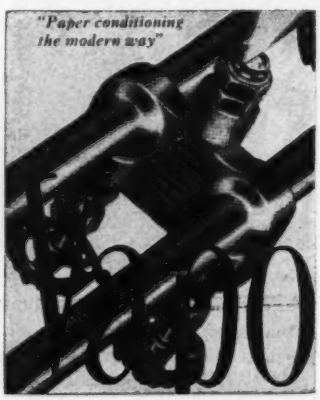
WESTERN REPRESENTATIVE:
JAMES BRINKLEY COMPANY, Seattle, Washington

Motor and generator brushes

Two new brushes have recently been developed for paper mill motors and generators. In the presence of high humidity and contaminants, a heavy film may form over a commutator's copper surface, giving rise to threading and grooving of the surface.

These two brushes, a carbon graphite grade for use on motors rated below 250 hp and on generators of less than 200 kw and an electrographitic brush for motors and generators of higher ratings, prevent the build-up of a heavy commutator film and are not sufficiently abrasive to wear the commutator cover. *Westinghouse Electric Corp., 3 Gateway Center, Pittsburgh, Pa.*



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Starches, Wax Emulsions, Plasticisers and other finish improvement solutions can be sprayed by VAPO SYSTEMS.

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132 W. Home Ave., Villa Park, Ill.

New Products . . . . . .

Magnetic flow meter

This new magnetic flow meter, now in use on pulp stock flow in prominent mills, according to the manufacturer, presents no more restriction to flow than a corresponding length of standard pipe. Purges of all types are said to be completely eliminated.

Basic unit of the meter is a transmitter which directs a magnetic field across an unrestricted section of Kel-F plastic or Neoprene-lined stainless steel pipe flanged into the flow line. Measurement is based on Faraday's law of induction. The flowing liquid acts as the conductor, generating a voltage directly proportional to its rate of flow through the pipe. Electrically connected to the transmitter is a Dynalog instrument, recording the units of flow on a linear chart. Automatic control totalizing and ratioing of various stock flows are standard additions.

The volumetric accuracy of the meter is said to be within 1 per cent of full scale. Calibration is independent of viscosity, density consistency, turbulence and and pressure.

Standard meters are available for line sizes from 2 to 8 in. *Foxboro Co., Foxboro, Mass.*

Propeller exhaust fan

A new heavy-duty propeller-type exhaust fan, designated as the Model K Ventura, is available with two-speed or constant-speed direct drive totally enclosed motors for industrial installations. A large range of sizes with capacities from 587 to 12,800 cfm are designed to operate against static pressures up to 5/8-in.

The streamlined inlet of the fan permits a free flow of air with minimum resistance in exhausting smoke, fumes and other contaminates. Precision fan wheel balancing techniques coupled with rugged, vibration-free mountings and supports for the enclosed motor are said to insure little maintenance and long-life. A square mounting panel design contributes to ease of installation. *American Blower Corp., Detroit 32, Mich.*

Takeup

A new one-piece hinged top frame permits easy access to the bearing block and adjusting screw. The top swings upward after three bolts are removed from the base. A new arch-frame design adds strength to the end brackets. Welded to the top cover angle, the brackets form a rigid frame capable of withstanding heavy loads without twisting or altering bearing alignment.

The improved DS takeup is interchangeable with previous designs for use on a wide variety of materials handling equipment such as apron, belt, chain, drag, flight, and slat conveyors, providing a positive, yet easy means of adjustment. The takeups are available with babbitted, ball, or roller bearings. Babbitted blocks have pipe top for grease cup or fitting. Ball or roller bearing blocks come with hydraulic-type fittings.

Other features include a rigid channel base and a sturdy adjusting screw that never projects beyond the end of the frame. *Link-Belt Co., Dept. PR, 307 N. Michigan Ave., Chicago 1, Ill.*

Coming Events

Tappi

Jan. 20-21—Southeastern Section, Francis Marion Hotel, Charleston, S.C.
Feb. 20-23—Annual meeting, Hotel Commodore, New York, N.Y.

American Pulp & Paper Mill Superintendents Association

Jan. 26—Miami Valley Division, Manchester Hotel, Middletown, Ohio
Jan. 27—Connecticut Valley Division, Roger Smith Hotel, Holyoke, Mass.

Other meetings

January—Forest Products Research Society, Inland Empire Section, Davenport Hotel, Spokane, Wash.
Jan. 25-27—CPPA Technical Section, annual meeting, Sheraton-Mount Royal Hotel, Montreal
Feb. 19-24—APPA Annual Meeting, Waldorf-Astoria Hotel, New York, N.Y.
March 8-9—American Institute of Electrical Engineers, conference on electricity in the pulp and paper industry, University of Florida, Gainesville

MARKET QUOTATIONS

RAGS (Domestic)

NEW RAGS

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No. 1 White Shirt Cuttings	14.50 to 15.50
New Unbleached Muslins. .	16.25 to 16.75
Fancy Shirt Cuttings ...	5.50 to 6.00
No. 1 Percales	6.50 to 7.00
No. 1 Washables.....	3.00 to 3.25
No. 1 Light Silesias	8.00 to 8.50
No. 1 Light Prints	5.50 to 6.00
Light Flannelettes	8.00 to 8.50
Cottonades	3.75 to 4.00
Blue Overalls.....	8.00 to 8.50
Blue Cheviots	8.00 to 8.50
Canton Flannels, Bleached	11.50 to 12.00
Canton Flannels, Unbleached	11.50 to 12.00
Osnaburg Cuttings	10.50 to 11.00
Underwear Cuttings, Bleached	16.00 to 16.50
Underwear Cuttings, Unbleached	16.00 to 16.50
Khaki Cuttings—	
Sun Tan	6.25 to 6.75
Mixed	3.75 to 4.00
Linen Cuttings—	
American	7.50 to 8.00
White	12.00 to 13.00
Grey	12.00 to 13.00

RAGS (Domestic)

OLD RAGS

Quotations to consuming mills, dollars per hundred pounds, f.o.b. New York, follow:

Booting	Per cwt.
No. 1	1.45 to 1.55
No. 2	1.35 to 1.45
No. 3 and 4	1.05 to 1.15
Twos and Blues—	
Repacked	2.50 to 2.75
Thirds and Blues—	
Repacked	2.25 to 2.50
Miscellaneous	2.00 to 2.15
Whites, No. 1—	
Repacked	4.00 to 4.25
Miscellaneous	3.25 to 3.50
White, No. 2—	
Repacked	3.00 to 3.25
Miscellaneous	2.50 to 2.75

RAGS (Foreign)

ex dock New York City

NEW RAGS

per cwt.

New Dark Cuttings.....
New Mixed Cuttings.....
New Light Silesias.....
Light Flannelettes.....
Unbleached Cuttings.....
New White Cuttings.....
New Light Oxfords.....
New Light Prints..... } Nominal

RAGS (Foreign)

ex dock New York City

OLD RAGS

per cwt.

No. 1 White Linens.....
No. 2 White Linens.....
No. 3 White Linens.....
No. 4 White Linens.....
No. 1 White Cottons.....
No. 2 White Cottons.....
No. 3 White Cottons.....
No. 4 White Cottons.....
Extra Light Prints..... } Nominal
Ord. Light Prints.....
Med. Light Prints.....
Dutch Blue Cottons.....
French Blue Cottons.....
French Blue Linens.....
Checks and Blues.....
Linsey Garments.....
Dark Cottons.....
Old Shopperies .....

ROPE and BAGGING

f.o.b. and ex dock New York City

	per cwt.
Gunny No. 1—	
Foreign	5.50 to 6.00
Domestic	5.50 to 6.00
Wool Tares—	
Light	5.50 to 6.00
Heavy	5.75 to 6.25
No. 1 Scrap Bagging .	4.75 to 5.25
Manila Rope—	
No. 1 large, dom.	7.50 to 8.00
No. 1 small	6.50 to 7.00
Sisal Rope—	
No. 1 large	6.00 to 6.50
No. 1 small	5.50 to 6.00
New Burlap Cuttings....	5.75 to 6.25
Jute Threads—	
Foreign (Nom.).....	6.00 to 6.25
Domestic	6.25 to 6.50
Strings—	
No. 1 sisal.....	4.75 to 5.00
No. 2 sisal.....	4.25 to 4.50
Soft jute.....	4.75 to 5.00
Mixed	2.00 to 2.25

WASTE PAPER

The following are quotations, dollars per ton, for No. 1 packing f.o.b. New York:

Shavings—	per ton
Hard White Env. Cuts.	140.00 to 150.00
Hard White No. 1 ..	110.00 to 115.00
Soft White, one-cut ..	90.00 to 95.00
Soft White, No. 1....	75.00 to 80.00
Fly Leaf No. 1	42.50 to 47.50
Fly Leaf, Woody No. 1	45.00 to 50.00
No. 2 Mixed Col. Woody	30.00 to 35.00
Flat Stock—	
No. 1 Heavy Books and Magazines, Repacked .	30.00 to 32.00
Mixed Books	23.00 to 25.00
Ledger Stock—	
No. 1 White	65.00 to 70.00
No. 1 Mixed (Colored)	42.50 to 47.50
Manilas—	
New Env. Cuttings ...	75.00 to 80.00
New Cuts, One-Cut—	
Extra Manilas	23.00 to 25.00
Manilla Tab Cards, Free of Ground Wood	95.00 to 100.00
Colored Tab Cards	75.00 to 80.00
Kraft—	
New Envelope Cuttings	85.00 to 90.00
Tripled Sorted No. 1 100%	45.00 to 50.00
No. 1 Old Assorted ..	32.50 to 37.50
News—	
White Blank	75.00 to 80.00
Overissue	29.00—
No. 1 Folded	26.00—
Old Corrugated Containers	24.00—
New Jute Corrugated Cuts	29.00—
Mill Wrappers	24.00—
Box Board Chips	18.00—
No. 1 Mixed Paper	16.00—

CHEMICALS

f.o.b. shipping point

Alum (Papermakers)—
Lump, cwt..... 5.05—
Ground, cwt..... 4.30—
Powdered, cwt. ..... 5.20—

Blanc Fixe—
Pulp, bulk, ton ....105.00—
Dry, barrels .....110.00—

Bleaching Powder—
Drums, cwt ..... 5.02 to 6.50

Casein (Domestic Standard)
20-30 mesh (bags), lb.
80-100 mesh (bags), lb. ..... 27.00 to 29.00

Argentine, lb. ..... 28.50 to 29.00

China Clay—
Domestic Filler
Bulk (mine) ton..... 10.00 to 13.00
Domestic Coating
Bulk (mine) ton.... 17.00 to 25.00
Imported (ship side)
Bulk (lump) ton... 30.00 to 30.00

Chlorine—
Tank cars (wks) cwt... 3.05—
Gelatine (silicon), lb... 1.25 to 1.35
Glyc. (C.P.) drums, lb. .30½ to .31
Litharge, Powd. bbl. lb .. .17 to .17½

Rosin (Gum)— New York, per 100 lbs.
E ..... 9.55—
F ..... 9.55—
G ..... 9.55—
WW ..... 9.70—
Rosin (Wood), carlots, F.O.B. South .... 6.50—
Salt Cake—
Dom. bulk (wks) ton 28.00 to 29.00
Imp. bulks on dock—
(Atl. ports) ton
(Nom.) ..... 22.00—
Soda Ash—
Bulk (works) cwt... 1.45—
Paper bags, cwt..... 1.80—
Soda (Caustic)—
Solid drums, cwt.... 4.10 to 4.85
Ground and flake, drums, cwt. ..... 4.50 to 5.25
Sodium Silicate—
60 deg. 55 gal. drums, (works) cwt..... 1.60 to 1.70
40 deg. 35 gal. drums, (works), cwt..... 1.35 to 1.40
Starch—
Pearl, 140 lb. bags, cwt. ..... 7.14—
Pearl, barrels, cwt. .. 7.14—
Paper (Sq.) bags, cwt. 7.14—
Powdered, barrels, cwt. 7.35—
Sulphur (Crude)
(Mine) bulk, long ton 26.50 to 28.00
Talc—
Dom. 100 lb. bags (mine) ton ..... 26.00 to 30.00
Canadian ..... 35.00 to 45.00
Titanium Dioxide—
Barium Pig, bbls., lb. .22½ to .23
Calcium Pig, bbls., lb. ..... .22½ to .23
Zinc Oxide, bags ..... 14.00 to 15.50

WOOD PULP

Quotations on domestic and Canadian wood pulp, dollars per short air dry ton, delivered consuming mills including basic freight allowances, follows:

Bleached Sulphite ....145.00—
Bleached Sulphite, Canadian .....150.00—
Unbleached Sulphite ...120.00—
Unbleached Sulphite, Canadian .....130.00—
Bleached Soda .....142.50—
Bleached Soda, Canadian.142.50—
Kraft Bleached .....147.00 to 150.00
Kraft, Bleach., Hardwood .....145.00—
Kraft, Bleach., Southern.150.00—
Kraft, Bleach., Canadian.150.00—
Kraft, Unbleached, Northern .....125.00—
Kraft, Unbleached, Southern .....112.50 to 120.00
Kraft, Unbleached, Canadian .....125.00—
Kraft, Semi-Bleached, Southern .....130.00 to 135.00
Sulphite Screenings .... 72.50—
Sulphate Screenings .... 67.50—
Groundwood ..... 80.00 to 85.00

Quotations on imported wood pulp, dollars per short ton, on dock American Atlantic ports with varying freight allowances, follow:

Bleached Sulphite, Swedish .....150.00—
Bleached Sulphite, Norwegian, freight allowed.145.00—
Bleached Sulphite, Finnish, freight allowed.150.00—
Unbleached Sulphite, Swedish .....130.00—
Unbleached Sulphite, Finnish, freight allowed .130.00—
Kraft, Unbleached, Swedish, freight allowed..115.00—
Kraft, Unbleached, Finnish, freight allow...115.00 to 145.00
Kraft, Bleached, Swedish, on dock....150.00—
Kraft, Bleached, Norwegian .....150.00—

PAPER

Quotations are mill quotations New York City

Boards—

Prices per ton, delivered in New York, 10 tons or more:

Plain chip	90.00—
News vat lined chip ..	95.00—
.009 chip, rolls	95.00—
Filled news	90.00—
Solid news	95.00—
White vat lined chip..	125.00—
Chip tube and can stock.	100.00—
Single manila lined chip.	140.00—
Single jute lined chip..	125.00—
Kraft liner	130.00 to 140.00

White patent coated:

.020	155.00—
.018	157.50—
.016	160.00—

Book Paper f.o.b. New York— per cwt.

Machine coated, two sides
70 lb. No. 2 enamel; 25x 4 cases $17.25
38-500, trimmed 4 sides. Carloads $16.30
45 lb. enamel, 25x38-500, 4 cases $13.05
trimmed 4 sides..... Carloads $12.10

Uncoated

55 lb. No. 2 offset, 25x38 4 cases $14.80
500, trimmed 4 sides.... Carloads $13.85
50 lb. A Grade English Finish, 25x38-500, un 4 cases $14.05
trimmed ..... Carloads $13.10
20 lb. envelope, 17x22-500, untrimmed ..... Carloads $12.40
16 lb. tablet, 17x22-500 ..... Carloads $11.35

Rag Content Bond—
(White, 5,000 to 10,000 lbs., basis 16 lb.)

100% rag.....	58.80—
75% rag.....	45.45—
50% rag.....	36.20—
25% rag.....	29.70—

Rag Content Ledger—
(White, 5,000 to 10,000 lbs.)

100% rag.....	58.80—
75% rag.....	45.45—
50% rag.....	36.20—
25% rag.....	29.70—

Sulphite Bond—
(White, 5,000 to 10,000 lbs., basis 16 lb.)

No. 1.....	20.10—
No. 2.....	20.40—
No. 4.....	17.75—

Sulphite Ledger—
(White, 5,000 to 10,000 lbs.)

No. 1.....	20.50—
No. 2.....	19.75—
No. 4.....	18.15—

News delivered in New York— per ton

Rolls, Standard (Contract)	129.00 to 132.00
Rolls (Spot)	(Nominal)
Sheets	140.00—

Tissues (Carlots) f.o.b. New York—

	per ream
White No. 1	1.85—
White No. 2	1.45—
Bleached Anti-Tarnish..	2.20—
Colored	2.00—
Anti-Tarnish Kraft ..	1.65—
Manila	2.00—
Napkins, semi-crepe (12½ lb. to M shts.) per cs.	1.00—
Napkins, full crepe and embossed (12½ lb. to Mshts.) per cs. ..	1.00—
Toilet, Bleached (M shts.) per cs.....	9.35—
Toilet, Unbleached (M shts.) per cs. ..	7.00—

Towels f.o.b. New York— per case

Bleached	6.80—
Unbleached	5.90—

Wrappings (Kraft) f.o.b. New York— (Basis 50 lb. & heavier) per cwt.

Standard wrapping	8.25—
Butchers, counter rolls..	8.50—
Standard bag, mill rolls.	7.75—
Shipping sack, mill rolls.	8.00—
Gumming, mill rolls....	8.25—
Asphalting, mill rolls...	8.00—
Envelope, mill rolls....	9.50—

NEW LITERATURE

Books

PIPE FRICTION MANUAL. Published by Hydraulic Institute, 122 East 42nd St., New York 17, N. Y. 8½ x 11. 87 pages. Paper-bound. $1.75 domestic; $1.85 foreign.

Material in this manual is an extension and rearrangement of the pipe friction data contained in an earlier publication entitled, "Tentative Standards of the Hydraulic Institute — Pipe Friction." Data is based on the latest information available.

The manual features a section demonstrating the mathematical calculations used in the construction of later charts. This is supplemented by complete tables of friction loss for water in feet per 100 feet of pipe. Wrought iron, steel and cast iron pipe sizes from ⅛ in. nominal to 84 in. I.D. are covered. Also given are tables of resistance coefficients for valves and fittings, 90° bends, diffusers, and others. The tables of resistance coefficients for valves and fittings include the latest available experimental data and show the values in more detail with respect to size and type than has heretofore been published.

The full-page charts showing the friction loss for the incompressible flow of viscous fluids for pipe sizes from ½ in. through 12 in. have been redrawn for greater clarity. Also included are three fold-in charts of friction factors with related data to permit the calculation of the friction loss for any fluid (liquid or gas) in any size or shape of conduit.

Of particular utility are numerous examples showing actual mathematical solutions to pipe friction problems.

The manual also includes a full list of the references showing the sources of the data.

CHEMICAL BUSINESS HANDBOOK. Edited by John H. Perry. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. 7 ¾ x 10 ¼. 1,320 pages.

A wide range of modern business management methods and practices, treated especially for their interest to the chemical and chemical engineering industries, is given thorough, detailed coverage. Although the book is focused on the chemical industry, most of it should be equally applicable to other industries.

The book consists of 20 sections in which 125 leading authorities discuss all major phases of business operations, from such subjects as finance and control by cost accounting to sales and advertising. Also included are commercial development, research, patent law, industrial toxicology, and many other subjects.

A unique feature of the book is a 280-page section summarizing the mass of market research data and information sources existing and spread through dozens of government and private sources. According to the publishers, the material will be especially useful for all types of research, production, and sales studies.

The presentation of business subjects, procedures, tables, data, forms for records and control, etc., represent the thinking and efficient practices of leading companies in the field.

The book is designed to be helpful both to the man ascending the executive ladder and seeking background and knowledge in fields outside his specialty and to the man requiring a detailed reference to answer all sorts of business questions and problems.

INSTRUMENTS FOR MEASUREMENT AND CONTROL. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y. Author, Werner G. Holzbock. 9 x 6. 371 pages. $10.00

This book describes and illustrates all the most recent devices for measuring and controlling temperature, moisture, pressure, flow, uniformity, etc. In non-mathematical language, the book discusses the design, construction and operation of instruments, shows how various instruments compare with each other, and points out the factors to consider in choosing the proper instrument for a particular job.

Covered are the various process variables and the commercially available instruments for their measurement; analytical process instrumentation; devices used in controller actions; and such final control elements as valves, pumps, transformers and motors. A special chapter on trends discusses the development of centralized systems, miniaturization and digital computers.

Manufacturers' Publications

Through the co-operation of manufacturers and suppliers, THE PAPER INDUSTRY *lists the following catalogues, bulletins and booklets. They may be obtained without cost or obligation, unless otherwise specified, by writing direct to the manufacturers. Please address requests on your company letterhead.*

V-Belt Drives. Worthington Corp., Mechanical Power Transmission Div., Dept. PI, Oil City, Pa.—This 100-page manual on Multi-V-Drives, designated as Book No. V-1400-E2F, presents a scientific and simplified method for rating V-belts. Each popular 60-cycle motor speed with complete drive selections is shown on separate pages. Complete information on products and complete range of stock size sheaves with bore limitations are included.

Polyhydric Alcohol. Hercules Powder Co., Dept. PI, Wilmington, Del. — The position of pentaerythritol relative to other polyols, some of the fundamental considerations leading to its increasing use, and technical advantages in terms of cost are explained in this pamphlet.

Parallel Shaft Gear Drives. Link-Belt Co., Dept. PR, 307 N. Michigan Ave., Chicago 1, Ill.—A complete line of parallel shaft gear drives is described in 32-page Book No. 2619. Complete engineering data, including simplified horsepower tables, dimensions, and overhung load capacities for selection from the standard line are given. Baseplates and built-in backstops are also covered.

Electrical Precipitation Equipment. Research-Cottrell, Inc., Dept. PI, Bound Brook, N. J.—This 28-page bulletin describes the general principles of electrical precipitation. Individual sections are devoted to its chief applications in various industries, including the pulp and paper industry.

Centrifugal Pumps. Aurora Pump Division, New York Air Brake Co., Dept. PI, 629 Loucks St., Aurora, Ill.—Bulletin 105-B, consisting of 8 pages, describes the Type O horizontal split case, double suction centrifugal pumps, including construction details, suggested specifications, a dimension chart, and a selection table showing range of output and heads. Cutaway views with parts lists illustrate the three types which comprise the series. Photographs illustrate typical applications. The complete line of Aurora pumps is also described and illustrated.

Flow Control Pumps. Milton Roy Co., Dept. PI, 1300 East Mermaid Lane, Philadelphia 18, Pa.—Three new 4-page data sheets on Controlled Volume pumps are now available. Data Sheet F-55-1 describes the use of these pumps in solving low-capacity flows of papermakers chemicals in stock preparation. Data Sheets F-55-2 and F-55-3 describe how leading paper mills employ Controlled Volume pumps to meter low-capacity flows of papermakers chemicals. The former discusses rosin emulsification and automatic alum dilution, while the latter discusses the technique employed to meter detergents, coating materials and wetting agents in machine coating and conversion.

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PAPER INDUSTRY

Whither?

. . . in production, processes, new products, markets

Dimethyl sulfide

The 2,000,000 lb. per year plant which goes into operation at Crown Zellerbach's Camas mill this month uses the black liquor from the second stage of evaporation. To this liquor is added Na_2S, and the resulting slurry is pumped to a continuous reactor, where it is heated under pressure at 660° F. for 10 minutes. The dimethyl sulfide, an important raw material in organic synthesis, is then recovered by a method of flashing and condensation.

Pulp, paper, and board output, 1956

The output of pulp, paper, and board in the first six months of 1956 is expected to proceed slightly in excess of the 1955 annual rate of 29,500,000 tons. The 1955 output broke the previous 1954 record by about 3,000,000 tons.

Electromagnetic waves prevent static electricity in paper

The old method of eliminating static electricity by the use of good conductors in grounding the paper sheet has never been too satisfactory. A new method makes use of electromagnetic waves of high frequency which ionize the air around the paper sheet and thereby prevent the accumulation of static electricity. This method uses very little power and has no health hazard as do some of the radiation methods for ionization of air.

Timber resources are good

For the first time in its history, the U. S. A. is now growing more timber than is being removed by cutting or destruction through fire, pests, or disease. The net annual growth is set at 14.2 billion cu. ft. with an annual cut and mortality of 10.7 billion cu. ft. The net volume of all standing timber is now held at 498 billion cu. ft.

Organic wastes can be burned at 10 per cent concentration

Water containing 10 per cent organic matter can be used in the Zimmermann wet combustion process which operates under 2,200 psi pressure. The Akteselskapet Borregaard, a Norwegian paper and pulp mill, is building a $3,000,000 installation to produce steam by this process at the estimated cost of 40-50 cents per 1,000 lb. of steam. The process was developed by Sterling Drug Inc.

Increased use of polyethylene paper coating

The consumption of polyethylene for paper coating in 1954 was more than 14,000,000 lb. For 1955, a consumption of 25 to 30 million pounds is anticipated.

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Here's THE SOLUTION

If you haven't investigated the advantages of using DARLING'S GLUE as an additive for improving retention, we believe it's worth your attention. The benefits derived from using a DARLING GLUE solution vary with mill conditions. Generally speaking, here is what to look for—

—a more uniform sheet . . . in terms of opacity, basis weight and ash content

—increased percentage of filler retained

—the possibility of faster machine speeds

We'd like to work with you in determining what can be accomplished in *your* mill. The cost is on us, so you've nothing to lose . . . plenty to gain. You can make arrangements through your DARLING sales representative. Or write or call us direct.

• *Promising results are also being obtained on* CYLINDER MACHINE *retention problems.*

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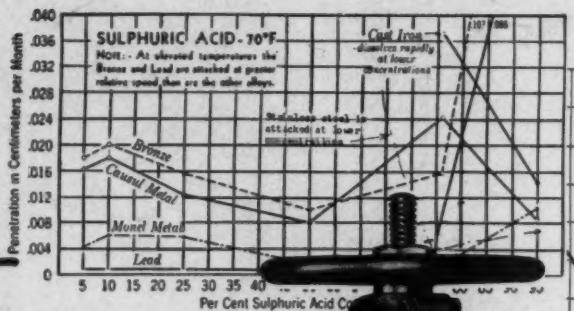

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with money-saving "CAUSUL" METAL VALVES

"Causul" Metal bodies and bonnets are far less expensive than the high alloys — but offer much better resistance to corrosion than cast iron or bronze. Trim is available in Type 316 Stainless Steel or Monel Metal, providing the best corrosion-resistance obtainable in the seats, discs, and stems. With this combination, you get excellent service at minimum cost . . . corrosion-resistant valve service that saves you money.

NOW WITH HEAVIER, STRONGER BODIES!

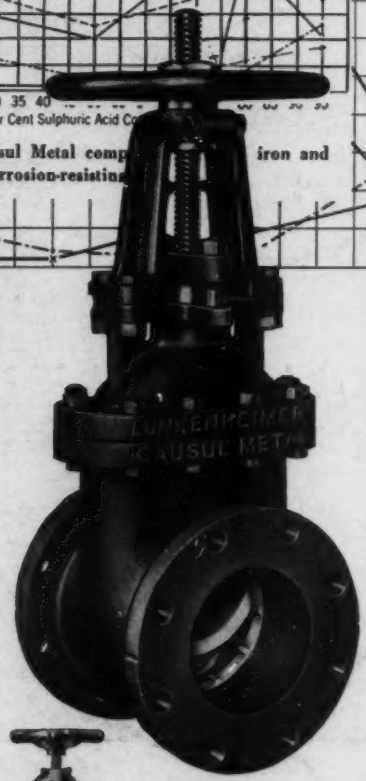
"Causul" Metal Valves are now made with heavier, thicker body walls for extra strength and durability. Castings are poured in a foundry specializing in handling this alloy.

NOW IN A GREATER RANGE OF SIZES!

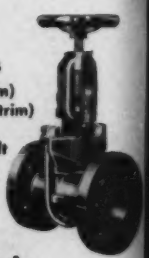
"Causul" Metal Valves are now made in a complete size range — ½ to 2 inch, screwed ends . . . 1 to 8 inch, flanged ends — with both Monel and Stainless Steel trims.

LUNKENHEIMER QUALITY

"CAUSUL" METAL is an exclusive Lunkenheimer development — containing iron, nickel, copper, chromium, and molybdenum. For detailed service recommendations, request a Confidential Service Information Form from your Lunkenheimer Distributor, or write to The Lunkenheimer Company, Box 360, Cincinnati 14, Ohio.



Screwed Ends
Fig. 2008-8 (Monel trim)
Fig. 2008-4 (Stainless trim)
½ to 2 inches



Flanged Ends
Fig. 2009-8 (Monel trim)
Fig. 2009-4 (Stainless trim)
1 to 1½ inches
2 to 3 inches—Two-Bolt Bonnet Design

Flanged Ends
Fig. 2009-8 (Monel trim)
Fig. 2009-4 (Stainless trim)
4 to 8 inches

BRONZE • IRON
STEEL • PVC VALVES

LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

L-355-11